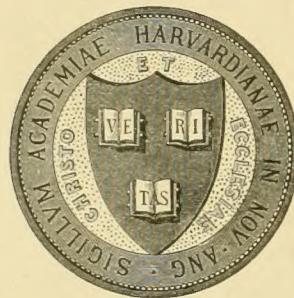




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ON TWO ORDERS OF ARACHNIDA
OPILIONES, ESPECIALLY THE SUBORDER CYPHOPHTHALMI,
AND
RICINULEI, NAMELY THE FAMILY CRYPTOSTEMMATOIDAE.

By

DR H. J. HANSEN, FOR.MEM.L.S., AND DR W. SØRENSEN, F.R.DAN.ACAD.
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PREFACE.

SOME years ago Dr. W. F. Purcell of the South African Museum at Capetown kindly offered to place at the disposal of one of us, who had long been engaged in the study of one of the suborders of Opiliones, a certain number of specimens of this order, collected near Capetown; and including a form which he described as "a species with no eyes, but having on either side of cephalothorax above a short tube, resembling strongly an eye-stalk, through which a liquid is ejected, when the animal is irritated." This statement excited our interest in a high degree for the following reason. Whilst the great majority of Opiliones are described as possessing only one pair of eyes, which are sessile, and a few species living in caves in North America are blind, others—and most of them belonging to the suborder Cyphophthalmi—are said to offer very remarkable deviations. *Siro Latreille* (*Cyphophthalmus Joseph*), *Pettalus Thorell* and *Miopsis Thorell* are said to have severally only one pair of eyes, these being placed on eminences more or less considerable; *Stylocellus Westwood* is stated to possess in addition to the pair of stalked eyes, a sessile pair placed in front of the former, and the dubious *Gibocellum Stecker* is credited with two pairs of stalked eyes, one in front of the other.

For our own part we had long entertained strong doubts as to the occurrence of more than one pair of eyes in any Opiliones. As regards Cyphophthalmi in particular—to which suborder the above-named genera belong—our doubts were strengthened by the fact that the openings of the odoriferous glands, which are so characteristic of Opiliones, have not been noticed by the writers in question. Seeing that authors of undoubted ability had mistaken the openings of the odoriferous glands in the common Harvest Spiders, which belong to Phalangioidæ, for (sessile) eyes, we were naturally led to suspect that the same mistake had been committed with regard to Cyphophthalmi. We should not, however, have ventured to express this suspicion without further justification, because numerous instances that have occurred in the history of science have taught us that such suppositions are, as a rule, of little value. Many years ago one of us undertook an examination of the exterior of the only specimen of this suborder which the Museum of Copenhagen at that time possessed, namely, a *Siro duricorius Joseph*, and as this examination did not lead to any doubt about the correctness of the unanimous statements of previous authors concerning the "stalked eyes," a supposition with regard to the eyes in *Stylocellus* would have been erroneous, as such a guess must have been that the sessile eyes in the last-named genus were the openings of the odoriferous glands.

The question, however, at once appeared to us in a different light when we received the communication of Dr. Purcell. It struck us immediately that the animal in question must belong to the suborder Cyphophthalmi, and that the "stalked eyes" of this group must be the openings of the odoriferous glands placed on eminences.

Dr. Purcell was kind enough, at our request, to send us that remarkable animal at once, and we have described it below under the name of *Purcellia illustrans*, because amongst all the animals belonging to this suborder, which we have examined, this one has been the most instructive to us. Thanks to our having a fair number of specimens at our disposal, we were able to obtain accurate knowledge of several structural features which are of importance in this suborder. At the same time the distinguished Arachnologist, Mr. Eugène Simon, presented us with a specimen of *Cryptostemma*, the examination of which led to results that seemed to throw more light on the hitherto little known order Ricinulei. Under these circumstances we resolved to undertake as thorough an investigation of these groups as we could, and for this purpose to bring together as much material as possible. This we considered so much the more desirable, as most writers have hitherto placed Ricinulei amongst Opiliones. Our applications were met almost everywhere with the greatest readiness to help, material for our investigation of these little-known groups of animals having been lent or even given us by the gentlemen and institutions named below, and we have accordingly much pleasure in expressing our warmest thanks to Professor E. Ray Lankester and Mr R. I. Pocock of the British Museum, the Rev. O. P. Cambridge, Professor E. B. Poulton of Oxford, Dr. W. F. Purcell, Prof. Dr. Max Weber and Dr. J. C. C. Loman of Amsterdam, Mr. Eugène Simon and Dr. G. Joseph of Paris, Dr. R. Gestro of the Museo Civico at Genoa, Prof. Dr. C. Emery of the Museum at Bologna, Dr. R. Sturany at Vienna, Prof. Dr. K. Möbius and Prof. Dr. F. Dahl of the Museum at Berlin, Prof. Dr. Chr. Aurivillius of the Museum at Stockholm and Prof. Dr. T. Thorell. We are especially indebted to Mr. Eugène Simon for his kindness in placing the whole of his excellent material at our disposal and even presenting us with several duplicates, as well as with a series of types of various Palpatores.—We have also to thank our friend C. C. A. Gosch, Mag. Sci., Attaché at the Danish Legation in London, for having translated our manuscript into English.

Moreover, in no mean degree, our thanks are due to the Royal Society of London which has done us the honour of accepting our paper for publication; for this we are so much the more grateful as it might have proved very difficult to get it published in our own country. And we desire to add our acknowledgments to the Cambridge University Press for the very admirable manner in which the illustrations have been reproduced and the text has been printed, and for their attention and courtesy.

Finally, we wish to express our warm thanks to the Rev. T. R. R. Stebbing, F.R.S., for having communicated our treatise to the Royal Society and for his very valuable aid in looking through all the proofs.

H. J. H. W. S.

June 15, 1904.

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ABSTRACT.

IN 1892 the renowned Swedish Arachnologist, T. Thorell, published a small paper in which he gave the first elaborate description of a species of the genus *Cryptostemma*, which is one of the main types of recent Arachnids. Before Thorell—who had only one old specimen of his species—two other species had been established, one by Guérin, the other by Westwood. Thorell followed earlier writers in referring the family Cryptostemmatoidæ Westw. to the order Opiliones, but he also established the type as a suborder and gave a key of the distinctive characters of the four suborders of that order. Two of these suborders, Palpatores and Laniatores, are very rich, each comprising a great number of genera with more than one hundred of known species; to Palpatores belong nearly all forms of European Harvestmen. The two other suborders are small, and animals belonging to them are scarce in all Museums. It may be stated at once that our paper deals with the whole order Opiliones in the sense of Thorell; and our treatment of his two small and hitherto very imperfectly known suborders, Cyphophthalmi (Anepignathi, Thor.) and Ricinulei (the family Cryptostemmatoidæ), is as complete as to morphology, anatomy, and classification as the material at our disposal allowed us to make it. But we at once perceived that Karsch was in the right when, in 1892, he removed the Cryptostemmatoidæ from the order Opiliones; we have established that family as a separate order, adopting for it the name Ricinulei, proposed by Thorell for his suborder of Opiliones comprising the same animals. The order Opiliones in the sense of Thorell and earlier writers is therefore here dealt with as two orders, Ricinulei and Opiliones, which are even very remote from each other. We had long been well acquainted with the two large suborders Palpatores and Laniatores, but our study of Cyphophthalmi gave rise to further investigations of numerous genera of both these groups, our purpose being to elucidate as completely as possible the differences between the three suborders adopted, and secondly to point out features which proved themselves to be of systematic importance in other respects. We give therefore a revision of the morphology of the dermoskeleton of Palpatores and Laniatores, the anatomy of their sexual organs, etc., and the distinctive characters of the families constituting the suborder Palpatores.

Our material of the order Ricinulei and the suborder Cyphophthalmi has been comparatively very rich—many times larger than that of any earlier author. When we began our study we applied ourselves to all sources where, in our judgment, it might be possible that material existed, and almost everyone has helped us as much as possible, lending us, or sometimes presenting us with, rare forms.

We shall attempt to give a short summary of the paper, but it must necessarily be rather imperfect, especially that part of it on Opiliones. It may be convenient to begin with the order Ricinulei. Of that group only three species had been named, each established on a

Abstract

single specimen, and no previous author had examined more than one specimen of any one species, except in a single instance when two specimens were available. We have examined externally all three species hitherto known, and also five new to science; six of these species are from tropical West Africa, and two from tropical South America. We have seen adult specimens of both sexes and young ones in various stages; we have had also the opportunity of dissecting an immature specimen; thereby we have been able to point out the characters of species and genera, and to elucidate the structure of the skeleton, the mouth, the respiratory and sensory organs. Some of the more important points may be mentioned. The structure of the mouth is rather similar to that in *Thelyphonus*; the mandibles ("maxillæ" auctorum) are completely fused with each other and with the proximal part of the labrum, but together with the labrum they can be moved a little. Of the labium sternale scarcely more remains than a few very long setæ; in *Thelyphonus* similar long setæ are found inserted in the middle line just behind the mandibles, but in both types they are difficult to find without dissection. Earlier authors found only four or five segments in the abdomen, but it consists in reality of nine complete segments, and the sexual opening is situated in front of the second sternite; the three posterior segments are small and generally completely withdrawn into each other. The abdomen is stalked and can be coupled or hitched to the cephalothorax; both these parts of the body are generally coupled firmly together, but the animal must be able to undo this coupling at pleasure, for instance when eggs are to be deposited. The fastening is effected by a peculiar development of the second and third abdominal tergites, the third sternite, the posterior margin of the cephalothorax and the fourth pair of coxae, these parts forming together a rather complex mechanism well adapted to the purpose. Such hitching is unique among Arachnids (and, for that matter, among Arthropoda); another unique feature is that the three anterior pairs of coxae are immovably fused, while the fourth pair is movable. The animals have but one pair of spiracles, and these are placed near the posterior extremity of the cephalothorax on a small piece of chitine inside the lateral border of the dorsal shield and above the third pair of coxae. From each spiracle a kind of sac takes its rise, and from the distal and the inner walls of this sac a great number of thin tubes originate which do not ramify and are without spiral thickenings; these tubes proceed to all parts of the body and the appendages. We point out that the organs of respiration in Arachnids may be referred to two types: one of these are tracheæ, as those of the Insects, viz. richly and gradually ramified tubes with spiral thickenings; to the other type belong the so-called lungs together with tracheæ of the kind met with in *Cryptostemma*, or slightly ramified tracheæ without spiral thickenings; the different kinds of organs referred to the second type are found in nearly allied orders or within the same order, often two of them in the same animal, and they are substituted one for the other in various ways within the same order (Araneæ), while respiratory organs of the two main types are never found in nearly allied orders or within the same order (Acari excepted).—Our investigation of the very complicated structure of metatarsus and tarsus of the third pair of walking legs in the male renders it probable that the pairing is brought about by spermatophores.—We prove that Ricinulei must be established as a separate order more closely allied to the order Pedipalpi (especially *Thelyphonus*) than to any other group; finally we arrange Pedipalpi, Araneæ, Ricinulei, and Palpigradi as a main division, *Arachnida micrura nobis*, pointing out the essential characters of that division and of its four constituents.

It is generally admitted that most Opiliones possess only one pair of eyes; very few cave-forms are known to be blind. Various authors have stated that in some forms more

than two eyes are met with, but we believed that this would probably prove to be erroneous. According to the literature of the subject nearly all animals of the suborder Cyphophthalmi possess one pair of eyes situated on big immovable stalks, and in the genus *Stylocellus* a pair of sessile eyes in addition in front of the stalked ones. Some years ago Dr. Purcell told one of us that a small form belonging to the Opiliones ejected a liquid through "a short tube resembling strongly an eye-stalk" and situated on the side of the cephalothorax. He lent us a number of specimens of this form which proved itself to be allied to *Siro*, a genus of Cyphophthalmi; it is described by us as *Purcellia illustrans* n. gen., n. sp. An anatomical investigation of this form, of a species of *Stylocellus* and of two other genera, gave the result that the terminal small areas on the processes hitherto regarded as eye-stalks are not eyes but openings of the odoriferous glands; such glands are well known in the two other suborders of Opiliones, and their openings are seen on the surface of the cephalothorax near or on its lateral margin. The sessile eyes known in *Stylocellus* are real eyes; *Stylocellus* has thus only one pair of eyes and the other Cyphophthalmi are blind; it may be added that in two blind genera a seta deviating in aspect and insertion from the other setae on the animal, and certainly being a kind of sensory organ, was found on the place corresponding to that where the eye is found in *Stylocellus*.

In the literature of this subject eleven species have been established as belonging to the Cyphophthalmi. One of them must be referred to another suborder; of the remaining species, referred to four genera, we have examined seven and are able to add seven new species. We have thus examined in all fourteen species, referred by us to six genera, and only one genus, and that probably of no great interest, is unknown to us; the genus *Gibocellum* Stecker, being a fabrication, must disappear. By dissecting representatives of four genera we have been able to give a complete account of the dermoskeleton, and to fill up several of the gaps in the knowledge of the inner anatomy, of which almost nothing was known. The Cyphophthalmi are a well-founded suborder, containing a single family, the Sironoidæ; the characters established by earlier writers for the family or the suborder were but few and most of them even incorrect, a fact easily explained by the smallness of the animals and the very scanty material which those writers had at their disposal. We point out a long series of characters for this suborder, and give besides a revision of the characters for the Palpatores and Laniatores, basing that revision on a renewed study of representatives of all families of these suborders and adding several new characters for the families of Palpatores, for the two last-named suborders, and for the order Opiliones.

I. THE ORDER OPILIONES, PARTICULARLY THE SUB-ORDER CYPHOPHTHALMI.

A. HISTORICAL INTRODUCTION.

IT must be admitted that our knowledge of Cyphophthalmi has been hitherto very limited, but it is long since the earliest known representative of this sub-order was first described. It was Latreille who in 1797 (*a*, p. 185) briefly characterised the genus *Siro*; in 1804 he named the species, which he had discovered, *S. rubens* (*b*, p. 329), and in 1806 he gave a tolerably good figure of the animal (*c*, Pl. VI., fig. 2). In the two last-named works he established the family Phalangita for the genera *Galeodes* Oliv., *Phalangium* Linn., *Trogulus* Latr., and *Siro* Latr. In 1833 Sundewall excluded the genus *Siro* from his order Opiliones to which he otherwise gave the same limits as it has to-day. He placed *Siro*—which he certainly did not know himself—in his family Galeodides (p. 33) which he placed in his order Solpugae together with the families, as he termed them, *Phrynidæ* (*Phrynus* and *Thelyphonus*), *Scorpionidæ* and *Obisidæ*, an arrangement whereby his orders were rendered very unequal in value. In 1839 C. L. Koch (*b*, p. 7) proposed the family Sironides for the genus *Siro*, with which, however, he was not himself acquainted, and he placed this new family in his order Solpugæ, which comprised not only the families Opilionides, Trogulides, Gonyleptides and Cosmetides (which all belong to the order Opiliones), but also the family Galeodides. Although Koch entitled his paper “Uebersicht des Arachnidensystems,” he did not set forth the characters either of the order or of the six families belonging to it, excepting Gonyleptides and Cosmetides. Whilst on this occasion he had closely followed Latreille he made in 1850 (*c*, pp. 95—104) this alteration, that though he otherwise preserved the order Solpugæ with the limits he had formerly assigned to it, he excluded the genus *Siro*, which does not appear at all in his system. In introducing this change he was obviously influenced by P. Gervais who in 1844 (*a*, p. 95) had said of *Siro*: “Celui-ci est cependant bien un Acarien du genre *Gamasus*, Latr., et le *S. rubens* nous paraît différent des Phalangides.” Unfortunate as this statement was, it was not inexcusable, because the figure of Latreille mentioned above was not so well executed that a person unacquainted with the animal itself could see that it did not represent one of the Acari, to which group Sironoidæ must really be said to bear a certain resemblance in their general appearance. Nor was Latreille himself without responsibility in the matter, as we see that in 1829 (*d*, p. 282) he had referred to the genus *Siro* *Acarus crassipes* Herm., which had been so excellently figured by Hermann that no one could be in doubt about its being an *Acarid*.

Latreille had found *Siro rubens* several times in France; but it was only after the lapse of 71 years that an animal of this group was again discovered; this time near and in the Luëger Cave in Austria by G. Joseph, who described (*a* and *b*) the new species as forming a new genus under the name of *Cyphophthalmus duricorius*, although it is really a species of *Siro*. This mistake is easily explained by the fact that it would not easily occur to him to look for Latreille's *Siro*, a forgotten genus which at that time was not

mentioned by anyone in connection with Opiliones. Four years later E. Simon found a new species in Corsica which he described as *Cyphophthalmus¹ corsicus* (*a*, p. 240). It was not till 1879 when Simon had re-discovered Latreille's *Siro rubens* in France itself that he (*b*) referred the European species to the old generic name of Latreille, giving at the same time a diagnostic description of the three species of that genus then known, which in almost all respects must be pronounced excellent. This number was increased by Joseph, who three years after described a new species (*c*, p. 20) under the name of *Siro cyphopselaphus*, which, however, undoubtedly must form a separate genus.

Meanwhile an Asiatic representative of the group Cyphophthalmi had been described by Westwood in his splendid Thesaurus entomologicus under the name of *Stylocellus sumatrana*s, and in the following year Cambridge described a species from Ceylon under the name of *Cyphophthalmus [Pettalus] cimiciformis*. In 1882 Thorell described (*c*) two species from Sumatra and Java, for which he proposed the generic name of *Leptopsalis*, because misled by a couple of errors and a *lapsus calami* in Westwood's description of *Stylocellus*, he did not venture to refer them to this genus. Afterwards, however, Thorell (*d*, p. 106) rightly judged that they really belonged to Westwood's genus, and even suggested that one of his species might be identical with Westwood's *St. sumatrana*s, but in this latter respect he was mistaken. In 1890 (*e*, p. 381) he established the new genus and species *Miopsis pulicaria* from Pulo Penang, and finally in 1897 Pocock (*b*) described a new species of each of the genera *Pettalus* and *Stylocellus*.

Amongst the eleven species hitherto described, we know from personal examination seven, in part through the original types, besides which we have become acquainted with seven new ones, and we are consequently able to add considerably to the number of described species. We do not, however, look upon this fact as the principal feature of our paper, because there can be no doubt that Southern Asia in particular is rich in these animals, whose rarity in the European Museums is probably due to their small size and, as it seems, hidden mode of life. That the family is also represented in America we know from a drawing of a North-American species, which Professor Thorell has kindly lent us, but we have been unable to obtain any specimen from that part of the world. The important advantage we have had consists in this, that we have been able to examine at one and the same time a greater number of genera and species than any previous writer. We have thus been enabled not only to acquire a more comprehensive knowledge of these animals than any of our predecessors, but also to enter into several questions, which they have either overlooked, or been obliged to leave unsolved. Besides this we have had the advantage of having so many specimens at our disposal of at least some species, belonging to 3 (4) genera, that we could afford to sacrifice one or more for an analysis of the dermoskeleton, and in this way arrive at a truer appreciation of the mutual relations of the genera of Cyphophthalmi, as well as of the position of this sub-order with regard to the two other sub-orders of Opiliones, viz. Op. Palpatores Thor. and Op. Laniatores Thor.² We have constantly

¹ In 1896 Hamann reproached Joseph severely for not having referred his new species to Latreille's *Siro*. If, however, he had known that three of the most learned Arachnologists of our time, Simon, Cambridge and Thorell (*a*, p. 469), likewise had forgotten Latreille's description he would scarcely, however anxious to decry his predecessor's merits in regard to the European Cave-fauna, have levelled against Joseph this reproach, which, in connection with his own so

to say antediluvian descriptions of various Opiliones, only proves how limited his own information is.

² For the benefit of readers who may not be quite familiar with the systematic grouping, we mention that to Palpatores belong the common Harvest Spiders and nearly all the European Opiliones, whilst Laniatores are represented in Europe only by a few species of the genus *Phalangodes* Tellkampf, but are numerous in warmer regions.

considered these together with Cyphophthalmi and we have therefore thought that we might usefully, at the conclusion of our paper, give a general *résumé* of the characters of all three sub-orders and of the families of Op. Palpatores¹. The morphology and mutual limitation of these two sub-orders must be considered to be fairly well known through the investigations of Thorell (*a*, 1876; and *f*, 1891), Simon (*d*, 1879), and Sörensen (*a*, 1873; *d*, 1884; and *e*, 1886), and we refer therefore, on the whole, to the papers of these authors. But our knowledge of Cyphophthalmi in these respects is as yet very limited. Perhaps no better evidence of this could be adduced than the fact that both the names which have been given to this group, viz. Cyphophthalmi and Anepignathi² are altogether misleading; but it is not less manifest from the diagnostic list of all the genera and of most species then known, which was compiled by Karsch in 1884 (*b*), because the disjunctive characters given in that paper all depend on errors of observation on the part of some author or other, or are merely sexual marks of distinction, whilst the new species added by Karsch himself does not belong to this sub-order at all, but to the family Troguloidæ (probably the genus *Metopoceta*) of the sub-order Palpatores. That this is the case has since been acknowledged by Karsch himself and we can confirm it, Professor Dr. Dahl having had the kindness to give us a sketch of the anterior part of the animal seen from above, as well as of the two hindmost pairs of legs.

We desire expressly to emphasize that in our opinion our predecessors, upon the whole, can scarcely be blamed for their errors, because these are mostly due to their having had but a few species before them, and our knowledge of these animals consequently being still in its infancy. We have accordingly been in doubt whether we ought to indicate in the general part of our paper in what respects we differ from our predecessors. We have decided to do so only in order to give a guarantee that we have not omitted to consider the views of earlier writers.

Whilst the interior structure of Palpatores and Laniatores is tolerably well known, very little information on this subject has been hitherto available with regard to Cyphophthalmi, all of it contributed by Joseph (*a* and *c*). We have therefore thought it worth while to communicate what we have been able to ascertain concerning the inner structure, in spite of its incompleteness.

When Joseph described *Cyphophthalmus (Siro) duricorius*, he made it the type of a separate family which he called Cyphophthalmida. In this respect his judgment has proved entirely correct, but the characters which he proposed for this family did not really contain any justification of it excepting the statement: "Partium genitalium orificium...patet" or, as it is expressed in the specific diagnosis, "partium genitalium fem. orificio primi arcus abdominalis apice prominente paululo obtecto"; because, as we shall show below, this feature really constitutes a character of the sub-order. For this reason Sörensen (*a*), who did not at that time know any representative of the group, declined in 1873 to acknowledge the family as such, nor had Simon (*a*) been induced to do so in 1872, referring, as he did, *Cyphophthalmus (Siro, Parasiro nobis) corsicus* to the family Troguloidæ of the sub-order Palpatores. Cambridge, on the contrary, accepted the family without comment, and Thorell did so (*a*, p. 468) pointing

¹ One of us (W. Sörensen) has for some years been engaged in a monograph of Laniatores.

² I.e. without clypeus and labrum (laminæ supramaxillares Thor.).

out at the same time several good characters¹ for the family, which he placed in the sub-order Op. Palpatores.

Until then, however, all authors had been of the same opinion with regard to the systematic position of the genus, in so far that they had all placed it near *Trogulus* and congeners; but in 1879 Simon erected a new sub-order comprising it and the two genera *Pettalus* and *Stylocellus*, which he only knew from descriptions. This new sub-order he named Cyphophthalmi, but he did not indicate more than one reliable character, which could justify the elevation of the group to a higher rank, and its separation from Palpatores, viz.: "Premier segment ventral de l'abdomen ne dépassant pas en avant les hanches de la quatrième paire." Thorell in 1882 (*c*) preserved the sub-order which he named Anepignathi, but he retained none of the characters given by Simon, and amongst those proposed by himself only one is correct, viz.: "labium sternale nullum." In 1884 Sörensen (*d*) came to the result by inspecting *Siro duricorius* Jos. that a labium sternale existed, and that lobus maxillaris of the first pair of coxae was movably connected with coxa; he therefore thought it right to keep the group (or genus) amongst Palpatores. But both these observations proved to be erroneous, and it is not only entirely justifiable but even quite necessary to keep the group as an independent sub-order.

In speaking of the representatives of this group, we have not referred to *Gibocellum sudeticum* Steck. We propose to treat of this in a separate chapter.

B. THE GENERAL STRUCTURE OF OPILIONES, WITH SPECIAL REGARD TO CYPHOPHTHALMI.

1. *The Dermoskeleton.*

In Palpatores the chitine on the body in general is of very different thickness in different groups; in the majority of Phalangioidæ it is rather thin, but in Sclerosomatini Sim. it is rather thick and of a peculiar coriaceous consistency, whilst in Gagrellini Thor. it is hard. In Ischyropsalidoidæ, Nemastomatoidæ and Troguloidæ the chitine is as a rule rather firm. In all Laniatores with which we are acquainted the chitine is very thick and firm, though of a somewhat coriaceous consistency. In those adult Cyphophthalmi which we have examined we found the chitine rather thick, in some cases even very thick and hard.

2. *Cephalothorax.*

Since the publication of Sörensen's first paper on Opiliones in 1873, authors who possessed a fairly intimate knowledge of the structure of Arachnida have rarely been in doubt about the boundary between cephalothorax and abdomen in these animals². In Laniatores no vestiges of the boundaries between the segments which compose cephalothorax are ever visible, whereby older authors were led to speak of it as "the head," such as C. L. Koch (*a*) who described it as "Kopf," whilst he called the three (or four) first segments of abdomen "Vorder-", "Mittel-

¹ "Palpi filiformes, art. 5° breviore quam 4°, apice unguiculo muniti. Pedes breves, metatarsis et tarsis robustis et ex articulo singulo constantibus, unguiculo longo. Segmenta dorsalia et ventralia, segmento vel segmentis duobus ultimis, supra et subter supra anum, exceptis, in scutum

dorsuale et scutum ventrale coalita."

² It is only in very rare cases that there is any difficulty in recognizing the boundary between cephalothorax and abdomen, as for instance in *Trogulus albicerus* W. S.

and "Hinterthorax" (pro-, meso- and metathorax). In Palpatores the case is very different. As regards Phalangioideæ the general rule must be said to be that the two segments which in our opinion compose thorax in Arachnida are clearly delimitated by two transversal grooves. Of these the anterior one is frequently less strongly marked than the posterior one, and in *Gagrella* Stol.¹, as well as in the allied genera *Melanopa* Thor., *Ceratobunus* Thor. and *Zaleptus* Thor., the anterior groove is more or less indistinct. In "*Homalonotus*" *depressus* Can., which is nearly related to *Sclerosoma*, it is entirely obliterated. In *Nemastoma lugubre* O. F. Müller the limits of the two thoracic segments are visible as two fairly well-marked transversal grooves, but they are only slightly marked in *N. scabriculum* E. S., *N. liliputanum* Luc. and *N. argenteo-lunulatum* E. S., and scarcely visible in *N. dentipalpe* Auss. and *N. gigas* W. S. In *Trogulus* Latr. it is impossible to distinguish the boundaries between the segments of cephalothorax, but in *Metopoclea* E. S., *Anelasmococephalus* E. S., *Dicranolasma* W. S. and *Amopaeum* W. S., which all belong to Troguloidæ, a slight transverse groove is visible which represents the boundary between the two thoracic segments. In *Ischyropsalis* C. L. Koch, Simon has already pointed out the existence of a cephalothoracic dorsal shield, on which a procurved transverse groove, which does not quite reach the lateral border, is observable, and in the majority of species also an abdominal dorsal shield formed by five tergites. It is, however, to be noted that the anterior, cephalothoracic, dorsal shield does not comprise the whole of the cephalothorax, but only the head and the dorsal arc of the anterior thoracic segment. That such is the case is seen most clearly in *I. Müller* and *Taracus Packardi* E. S. In *I. Müller*, where no abdominal dorsal shield is formed, as the tergites of the abdomen all remain free, a separate, slightly chitinized plate is seen behind the cephalothoracic shield, and in front of the abdominal tergites. This plate is very short, in the female as broad as the cephalothoracic dorsal shield and much broader than the first abdominal tergite, whilst in the male it is a little shorter and perhaps still more slightly chitinized and therefore somewhat more difficult to discern. In *Taracus Packardi* E. S. the abdominal dorsal shield consists of five tergites, which coalesce completely, but nevertheless may be discerned (counted), each of them bearing a couple of lightly coloured spots close to the lateral border. Between the two shields a broad and rather long dorsal plate is situated, which is entirely free of the anterior shield, but scarcely quite separate from the abdominal one. Inasmuch as the number of tergites behind the plate just described is the same as the number usually found in Palpatores, that plate cannot be anything else than the dorsal portion of the posterior thoracic segment. In the females of the other species of *Ischyropsalis* with which we are acquainted, viz. *I. luteipes* E. S., *I. pyrenaea* E. S., *I. dispar* E. S. and *I. Adamsii* Can., there is between the two dorsal shields a band of softer integument, rather long in the three first-named species, but rather short in *I. Adamsii*, traversed by a fine sharply cut groove which indicates the boundary line between two segments², though the dorsal plate behind this groove is so slightly chitinized that it does not appear distinct from the connecting membrane behind it. In the male of *I. dispar* E. S. this soft belt is so short, that we have not been able to discover the groove in question. In *Sabacoon paradoxus* E. S., *Parasabacoon*

¹ In *Gagrella minax* Thor., however, two boundary lines of segments are clearly observable, of which the posterior one as well as the limit between cephalothorax and abdomen are marked by rather broad bands of lighter colour, which almost reach the lateral margins of the body, and consist of a softer skin than the dorsal shields before and behind them. The same is the case with several other Gagrellini in

the Museum of Copenhagen.

² According to Simon's figure (b, Pl. XXIV. fig. 4) a similar groove occurs also in *I. nodifera* E. S. ♀, in which species the abdominal tergites are separate in the female, while a dorsal shield is said to exist in the male (v. Simon, *ibid.* pp. 270 and 271).

Cephalothorax

("Nemastoma") *crassipalpis* L. Koch and *Tomicomerus bispinosus* Pav., which are all nearly allied to *Ischyropsalis*, the same structure is found in all essential points. There is a separate cephalothoracic dorsal shield with a transverse groove, and between this shield and abdomen, which in all these species is rather soft, a dorsal plate is found which carries a couple of fine spines, and is of the same length and consistency as the abdominal tergites. On the original specimen of *Parasabacon crassipalpis* (L. Koch) and in those of *Tomicomerus bispinosus* Pav. the abdominal tergites are difficult to count, but in *Sabacon paradoxus* it is easy to count them and thus to convince oneself that the plate in question is here really the posterior dorsal segment of cephalothorax. Considering further that this plate in all these three nearly related forms is equipped with a pair of fine spines, as already mentioned, it is evident that in *Parasabacon crassipalpis* and in *Tomicomerus*, it belongs likewise to cephalothorax and not to abdomen¹. Although this structure is not without a parallel elsewhere, viz. in *Gagrella minax* and allied species², it must nevertheless be regarded as very characteristic of *Ischyropsalis*, *Taracus*, *Tomicomerus*, *Sabacon* and *Parasabacon*.

As regards Cyphophthalmi, it has never been doubted that the boundary between cephalothorax and abdomen is indicated by the foremost of the straight (or almost straight) grooves on the dorsal shield, opposite the extremities of which groove the body is a little contracted. In front of this straight groove another is visible which is strongly curved, our *sulcus posterior cephalothoracis* (several figures on Pls. I.—V.), and points on either side to the space between the third and fourth pair of coxae. That this groove, which is absent only in *Parasiro corsicus* E. S. (Pl. V., fig. 2 a), really forms the boundary between the two thoracic segments cannot be doubted, partly because of its position and partly because it is known from Phalangioidæ that the foremost of the two segmental boundaries is the first to disappear. In several forms the lateral portions of the posterior thoracic segment are marked off from the middle portion by an impression which is more or less distinct in the species of *Stylocellus* (Pl. I., fig. 1 d) and particularly marked in *Pettalus brevicauda* Pock. (Pl. III., fig. 3 a). In *Purcellia* (Pl. IV., fig. 1 a) this segment is the broadest portion of the whole body, but generally the greatest width is found across the second or (in *Pettalus brevicauda*) the third tergal plate of abdomen.

In front the cephalothorax is more or less rounded downwards, but the anterior extremity projects in the middle beyond the base of the antennæ (chelicerae) forming a prominent collar, which is well developed in *Stylocellus* (Pl. I., fig. 1 d, c), *Ogovia* and *Pettalus*, but smaller in *Purcellia*, *Siro* and *Parasiro*. The anterior part of the sides of cephalothorax are at the same time generally somewhat concave, and thus a broad, rounded, longitudinal ridge is formed which anteriorly occupies the middle of the body, and in front terminates in the collar, where generally it is expanded in the shape of a triangle. In Laniatores we are not aware of anything corresponding to this collar, because the "limbus anterior," as we call it, which often occurs on the dorsal shield does not, in our opinion, correspond to it. But we believe that this collar is represented in Palpatores by that piece or those pieces which are often found in the membranaceous part above the base of

¹ Pavesi describes the segment which carries the pair of spines from which he has named the species, as the first abdominal, a view which is very natural in the absence of a comparative study of the question. We would take this early opportunity of emphasizing that we cannot share the opinion of Pavesi, that the families Nemastomatoidæ and Ischyrop-

salidoidæ must be united on account of *Tomicomerus*. We place *Tomicomerus* between *Taracus* and *Sabacon*. We may add that through the courtesy of Professor Emery we have been able to examine the original specimens described by Pavesi.

² See above, p. 5, note 1.

the antennæ, as has been indicated already in a few words by Simon (*b*, p. 117). This piece is found, for instance, in the shape of a short and rather broad plate in *Tomicomerus* Pav., *Sabacon* E. S., and *Parasabacon*, but it is wanting in *Ischyropsalis*, *Taracus* and *Sclerosoma*. In those Phalangioidæ whose integuments are comparatively soft, the collar is but little developed and so much the less conspicuous as it is often placed on the anterior extremity of cephalothorax under the anterior margin of the dorsal shield; but in Phalangioidæ with harder integuments, such as *Phalangium propinquum* Luc., and *Ph. cirtanum* C. L. Koch, the collar is conspicuous in the shape of a transverse piece of chitine which is situated above the base of antennæ, and somewhat bent downwards; it shows here a longitudinal groove along the middle and is continued downwards as a narrow strip between the antennæ. In *Gagrella* Thor. and allied genera we find either one such piece, as in *G. Fee* Thor., or three pieces, as in *G. minax* Thor., a small portion on either side being separated from the main part in the middle, by an extremely fine groove in which the skin is soft¹. In *Nemastoma* there are known to be three pieces. In Troguloidæ they are discovered with some difficulty because, like the antennæ and the dorsal parts of the mouth, they are concealed by the ocular tubercles or by the processes of the ocular tubercle. In *Trogulus* and *Dicranolasma* they are very well developed. In *Trogulus rostratus* Latr. the middle part is a large pentagonal piece, whilst the lateral portions are very small. In *Dicranolasma*², on the contrary, the middle portion is rather small and has the form of an equilateral triangle, whilst the lateral pieces are somewhat larger. The position of these pieces in Palpatores is somewhat varying, principally in accordance with the shape of the anterior extremity of cephalothorax. In Troguloidæ their position is perpendicular, but it is slanting in the majority of Phalangioidæ and in Nemastomatoïdæ. In the former of these two groups they frequently carry a pair of protuberances which stand close together and which are particularly well developed in *Gagrella* and allied genera. In *Gagrella* and congeners the pieces in question seem to have a tendency to assume a position in continuation of the dorsal shield, and in *Nemastoma* they do so altogether; in *Pantopsis* E. S., which is distinguished by enormously long antennæ, the collar simply coalesces with the anterior border of cephalothorax, but may be discerned by the longitudinal groove in the middle which is found in this genus, as in all Phalangioidæ where this piece is (or these pieces are) well developed.

Simon has pointed out (*b*, pp. 117 and 267) that in *Ischyropsalis* a small piece of the lateral margin on either side remains independent and separated from the rest of cephalothorax by a narrow strip of soft skin. On these "pièces épimériennes" (an appellation which does not appear to us very happy) the openings of the stink glands are situated, but they do not appear as independent pieces in *Taracus* E. S., *Tomicomerus* Pav.³, *Sabacon* E. S., or *Parasabacon* n. gen. Vestiges of such independent pieces are frequently seen in Laniatores, a groove which only diverges a little anteriorly being often visible near the lateral border of cephalothorax ("limbus lateralis" W. S.). In Cyphophthalmi no vestiges are traceable of such "pièces épimériennes."

¹ *Leiobunum*, which upon the whole approaches *Gagrella* and its relatives, does so also in this point: the piece of chitine in question agrees essentially with that in *Gagrella Fee* as to shape and degree of development, though it is less firmly chitinized and occupies a lower position. In this re-

spect, as in others, the structure observed in *Gyas* E. S. and *Prosalia* L. Koch, shows that these genera are not nearly allied to *Leiobunum*.

² An undescribed species from Sicily.

³ Pavesi is of opinion that they exist in *Tomicomerus*.

Sternum is rather long in Laniatores, as it always reaches as far behind as the anterior margin of the fourth pair of coxae, and as the proximal extremities of the second and third pairs of coxae are broader than in other Opiliones. Anteriorly sternum is continued into the space between the lobi maxillares of the first pair of coxae, forming a labium sternale. The distance between the genital orifice and the mouth is therefore greater in Laniatores than in other Opiliones. Sternum is at the same time very narrow; it is only in certain genera, of Triænonychoidæ, that it expands at the posterior extremity as shown by Loman (*f.* pp. 525—528). In Palpatores, on the contrary, sternum is always short, but it shows a good deal of variation in other respects. In Phalangioidæ it is not separated from labium, but sternum proper, that is, the portion which is situated behind lobi maxillares of the first pair of coxae, forms a transverse approximately rectangular plate, which is almost entirely concealed by the projecting plate of "arculi genitales" which we intend to describe more particularly in the third chapter; sternum is separated from this projecting part by a groove in which the skin is soft. In Nemastomatoidæ and Troguloidæ (see woodcut fig. I) sternum is not separated from the anterior transverse portion of "arculi genitales," but it is separated from labium¹ by a strip of soft skin. In *Ischyropsalis* sternum is separated from "arculi genitales" by a groove with soft skin, but it is joined into one piece with labium; the two together form a plate of greater length than width, in shape resembling a trapezium rounded anteriorly, and firmly chitinized through the greater part of its extent. In *Taracus* E. S. sternum is separated from "arculi genitales" by a curved transverse groove, and forms, together with labium, a triangular anteriorly rounded piece; sternum proper is soft, but the basal portion of labium, which is not distinctly separated from sternum, is firmly chitinized. In *Sabacón* E. S., *Parasabacón nobis*, and *Tomicomerus* Pav., sternum is separated from labium, but not from "arculi genitales"; it is proportionally large, broad, and almost soft.—As regards Cyphophthalmi we may state at once that a labium sternale is absolutely wanting, and that hitherto nearly all writers have generally ascribed to sternum a greater length than it possesses. Sternum has mostly been described as reaching to the soft part of the mouth, whereas in reality it never reaches so far forward as the middle of the proximal extremity of the second pair of coxae². In *Stylocellus* (Pl. I., figs. 1*l*, 1*m*, 2*c*; Pl. II., figs. 1*c*, 2*c*, 2*d*) sternum is a very small, but thick and firmly chitinized triangular piece, which posteriorly touches "arculi genitales" (the frame which anteriorly and laterally encloses the genital orifice), whilst on either side it reaches the proximal extremity of the third pair of coxae; anteriorly sternum enters between the proximal extremities of the second pair of coxae. In *Ogovia* (Pl. III., fig. 1*d*) sternum is quite as large as in *Stylocellus*; although we have not had an opportunity of dissecting this animal, we believe that it is thick and firmly chitinized as in *Stylocellus*, because the condition of sternum seems to depend on whether the second pair of coxae are movable or not; and they are immovable in *Ogovia* as well as in *Stylocellus*. In *Purcellia* (Pl. IV., fig. 1*h* and 1*j*)

¹ In a preliminary paper published a long time after our text was written, C. Börner deals with many points in the morphology of Arachnidæ. We think that we are justified in confining ourselves to a few remarks. We are quite unable to concur in his opinion on labium sternale: it is impossible with Börner (p. 441, figs. 6 and 7) to consider labium in Aranæ and labium in Amblypygi as not homologous with each other; furthermore it is impossible to follow him (figs. 5 and 7) in considering a part situated *in front* of the mandibles in Uropygi as homologous with labium sternale in Aranæ, as in the latter group it originates *behind* the

mandibles. Finally he has overlooked labium sternale in *Trogulus*, which was known many years ago, but he states correctly that a labium does not exist in *Stylocellus*, a feature which, for the rest, had already been pointed out by Thorell (c. p. 22).

² It may be mentioned that Thorell writes in 1882 (c. p. 22) on Anepignathii: "Sternum nunc breve, nunc longum; labium sternale nullum." According to this statement he says (p. 23), on *Stylocellus*: "Sternum breve," while he (p. 24) describes and figures sternum in *Siro corsicus* as long, reaching from arculi to the posterior margin of stomotheca.

sternum is of similar shape and position as in *Stylocellus*, but is relatively somewhat smaller; preparations treated with caustic potassium show that in this genus sternum is not firmly chitinized but consists of thin pellucid skin. In *Pettalus* (Pl. III., figs. 2f and 3c) sternum is also of similar shape and dimension as in *Stylocellus*; we have not been able to ascertain by means of dissection, whether it is firm or consists of soft skin; but as the second pair of coxae are movable in *Purcellia* and *Pettalus*, contrary to what is the case in *Stylocellus*, and as the lobi maxillares of this second pair of coxae are very similarly developed in these two genera, we believe ourselves justified in assuming that sternum in *Pettalus* is of a similar thin quality as in *Purcellia*. In *Siro* (Pl. V., figs. 1g and 1h) and *Parasiro* (Pl. V., figs. 2e and 2f) no real sternum exists; none such is discoverable by external examination, and preparations of specimens of both genera treated with caustic potassium show that the thin and extremely narrow strip of skin, which connects the coxae of the second pair in the middle of the under surface of the body, is not dilated posteriorly in any noticeable degree. In both genera the second pair of coxae are movable, but the lobi maxillares of these limbs differ much from those in *Purcellia* and *Pettalus*, in size and still more in shape.

3. Abdomen.

The structure of abdomen in Opiliones is rather complicated and its morphology difficult to elucidate, because several of the elements—tergites and sternites—composing it are either so completely fused that they cannot be recognized without a comparative investigation of representatives of most families, or some of them have vanished completely in many forms. In this long chapter we attempt to give a detailed description which leads to a new interpretation of several of its parts. But in order to help the reader as much as possible, we thought it advisable to begin with a summary of our main results; then we proceed to the description, numbering the sternites—and tergites—according to the earlier mode of counting; we hope in this way to lead the reader gradually to the morphological understanding of the facts we point out. We begin with the Cyphophthalmi, because all the component elements of abdomen are more easily observed in this than in any of the other sub-orders.

The summary of our results may be as follows. The abdomen in Cyphophthalmi consists of nine complete segments besides operculum anale. The eight anterior tergites are fused with each other, but, nevertheless, easy to count; the ninth tergite is movably connected with the eighth. The ventral side shows nine sternites; the first sternite embraces, as "arculi genitales," the genital opening on the sides and in front; the second and third sternites constitute together a large plate which is described as the first sternite by earlier writers; the spiracles are situated in the second sternite, and the middle part of this sternite is produced forwards so as to form operculum genitale, which in this sub-order is immovable, reduced or sometimes quite rudimentary; the fourth to ninth sternites are generally all easily seen. In the two other sub-orders the anterior ventral part of abdomen consists of the elements as in Cyphophthalmi: the large plate, generally named the first sternite, consists of the second and third sternites, which often are marked off from each other by a transverse impression; the first sternite is sometimes—in Laniatores—very reduced, sometimes well developed as conspicuous "arculi genitales"; in Phalangioidæ these arculi are composed of a large lateral portion marked off from the fourth pair of coxae by an oblique furrow, and a middle portion in front of the genital aperture. In Palpatores abdomen presents considerable differences in the four families, its posterior portion being less reduced in

Troguloidæ and Nemastomatoidæ, more so in Ischyropsalidoidæ, and still more reduced in Phalangoidæ, especially in *Phalangium* and allied genera. In the two first-named families we are able to point out nine tergites and nine sternites besides operculum anale, in the sub-family Phalangiini (*Phalangium* and congeners) eight tergites and seven sternites, while in Ischyropsalidoïde and the sub-family Sclerosomatini we find the structure intermediate in various degree between that met with in Nemastomatoidæ and Phalangiini. We consider operculum anale in all Opiliones as a terminal segment of which only the dorsal part is developed¹. The result is, that in Cyphophthalmi and in many Palpatores we count ten segments, all complete with exception of the terminal one; in many Palpatores the eighth, and especially the ninth segment, is more or less reduced or has vanished; in Laniatores we have found generally nine sternites, and never more than eight tergites besides operculum anale; but, nine sternites being present, we think that abdomen in reality must be composed of ten segments.

In all Cyphophthalmi cephalothorax and the tergites of the eight first abdominal segments coalesce so as to form a dorsal shield, of which the posterior margin is turned a little downwards to the under surface, in consequence of which the apparent posterior extremity of the body is formed by the tergite of the eighth abdominal segment. The boundaries of these eight tergites are marked by grooves which are all quite distinct, with the exception that the last of them is somewhat indistinct in (the male of) *Pettalus* on account of the peculiar excavation near the apparent posterior extremity of the body which distinguishes (the male of) this genus. The tergite of the ninth segment and operculum anale are situated on the under surface of the body; the ninth tergite is, as a rule, quite short, of semilunar shape, and longer at the sides than in the middle; it is always movably connected with the dorsal shield (that is to say with the eighth tergite) and with operculum anale, but it does not rarely—in *Ogovia nobis* (Pl. III., fig. 1 e), and *Siro* Latr. (Pl. V., fig. 1 b and 1 i), but not in *Parasiro nobis* (Pl. V., fig. 2 g)—coalesce with the two sternites, which apparently are the sixth and the seventh, but in reality are the eighth and the ninth. With its posterior concave margin the ninth tergite embraces operculum anale which is nearly circular. In front of the posterior margin of operculum, between it and the so-called seventh, really ninth, sternite, anus is situated, marking the real, morphological, posterior extremity of the animal.

Apparently abdomen has only seven sternites, and to begin with we shall number them accordingly. The “seventh” (really ninth) sternite is semilunar in shape and always very small, in any case somewhat smaller than the ninth tergite, together with which it embraces operculum anale. In *Stylocellus* (Pl. I., figs. 1 b and 1 o) the “seventh” sternite is only slightly, at the sides, encompassed by the ninth tergite, so that the latter only to a very small extent touches the “sixth” sternite, but in *Pettalus* (Pl. III., figs. 2 b and 2 g), *Purcellia* (Pl. IV., figs. 1 b, 1 i and 1 k), *Siro* (Pl. V., figs. 1 b and 1 i), and *Parasiro* (Pl. V., fig. 2 g), the ninth tergite reaches fully round the sides of the “seventh” sternite, so that the lateral extremities of the former

¹ Thorell was the first who, in 1876 (a, p. 458), was led by comparative studies to interpret operculum anale as the tergite of the ninth segment in Op. Palpatores and Laniatores; but as regards Cyphophthalmi, he interpreted in 1882 (c, p. 23 and 26, bis) operculum anale in *Stylocellus*, as the last sternite, although it much resembles operculum anale in Laniatores, and he counts consequently nine tergites and nine sternites.

He was no doubt induced to do so by two causes, viz. that he had not seen the position of anus in *Stylocellus*, and the consideration that he then could count an equal number of tergites and sternites. Pocock, on the contrary (a, Pl. II, fig. 12, and b, p. 289), pronounced that the operculum anale was an “anal sclerite.”

reach up to the "sixth" sternite. The "seventh" sternite is never movably connected with the "sixth." Generally the boundary between them is marked by a distinct groove (in *Stylocellus* and *Purcellia* ♀), but in some cases (in *Pettalus*, *Purcellia* ♂ and in *Parasiro*) this groove is difficult to see or even obliterated in the middle, while plainly visible at the sides. In *Siro* (Pl. V., fig. 1*i*) the "sixth" and "seventh" sternites are almost fused into one, the groove being almost entirely invisible even at the sides; at the same time the grooves indicating the boundaries between the ninth tergite and these two sternites are so slightly marked in this genus that it is very difficult to recognize them. As it was only through previous study of other genera, that it became possible to discover or understand the true structure in *Siro*, and as it is sufficiently difficult to recognize it in *Parasiro*, it is easily understood that authors, who were acquainted only with one or both of these genera, have fallen into mistakes as to the number of tergites and sternites in these small animals¹. Of *Ogovia* we have had only one and that a unique specimen before us, which we were enabled to inspect by the kindness of M. E. Simon, and which we could not, therefore, dissect; but as the result of a careful examination of the exterior, we believe ourselves justified in saying that it agrees entirely with *Siro* in this point, that the "sixth" and "seventh" sternites are at the sides almost entirely united to the ninth tergite; and it is only on one side that we believe ourselves to have seen a vestige of the groove dividing the two sternites (Pl. III., fig. 1*e*).

The "fifth" sternite is always movably connected with the "sixth" and the "fourth," but the "first," "second," "third," and "fourth" sternites are united so as to form a ventral shield, the boundaries between them being marked by transverse grooves (Pl. I., fig. 1*b*; Pl. II., fig. 6*a*; Pl. III., fig. 2*b*; Pl. IV., fig. 1*b*; Pl. V., fig. 1*b*). Upon the whole the sternites increase in size forwards, but the "first" is disproportionately larger than any of the others. On this sternite a pair of curved grooves are discernible behind the spiracles, our "sulci laterales obliqui" (Pl. I., fig. 1*b*, *t*), each of which commences at the lateral margin of the body and sweeps round the spiracle inside of it. There can be no doubt that this "first" sternite is formed by the coalescence of two or three, as already Thorell thought (c, p. 26), but we prefer to leave the question, where the limits between the united segments are to be located, open for the present, because in the young *Stylocellus sulcatus*, n. sp. (Pl. II., fig. 3*h*), and also in the young *Purcellia illustrans* (Pl. III., fig. 4*c*), we have noticed that two small areae in which the spiracles are situated are separated from the rest of the "first" sternite by a groove in which the integument is quite soft, whilst *sulci laterales obliqui* in the young *Pettalus brevicauda* Pock. are very plainly connected with each other by a groove extending across the "first" sternite.

In Cyphophthalmi, as in Opiliones generally, abdomen extends forwards on the ventral side into the space between the coxae on either side. The "first" sternite is anteriorly prolonged into a plate of varying shape, "operculum genitale" (Pl. I., fig. 1*b* and *r* in figs. 1*l* and 1*m*), which in all other Opiliones is movably connected with the main part of the "first" sternite, but in Cyphophthalmi is immovable; at the utmost it is separated from the rest of the "first" sternite by a suture. Nor does operculum genitale ever close the genital orifice in Cyphophthalmi, in which respect this sub-order differs from the other sub-orders of Opiliones. The remaining part of the frame round the genital orifice, our

¹ Thus Simon (*b*, p. 143) and Sørensen (*d*, p. 559) counted eight tergites and six (clearly distinguishable) sternites. Joseph on the contrary (*b*, p. 270) counted eight of each.

"arculi genitales" (Pl. I., figs. 1 *l* and 1 *m*, *m*), are therefore seen very distinctly in almost the whole of their extent. They surround the orifice laterally, in front, as well as above. With regard to the morphological value of these "arculi genitales" we refer to the later portion of this chapter, which is devoted to morphological questions and in which we propose to discuss the relations of the abdominal segments in the whole order.

We would mention here only, that it can scarcely be denied that the genital orifice belongs to that portion of the "first" sternite which is situated behind it.

The preceding description of abdomen applies to the adult animals. We would therefore add, that although we have had opportunities of examining earlier stages of but a few species (*Stylocellus sulcatus* n. sp., *Purcellia illustrans* n. gen., n. sp., and *Pettalus brevicauda* Pock.), these have in several respects afforded interesting particulars. One of these is that in young specimens a larger or smaller number of the abdominal segments are free, with regard to which we refer to the special (Latin) description of these three species. Another interesting point is the appearance of the dorsal surface in young animals. The dorsal surface of *Stylocellus sulcatus* shows a longitudinal groove, in which a narrow strip of soft skin is found in the young on the first seven tergites, so that these plates here really are divided, whilst the eighth and ninth are entire. In a young *Purcellia illustrans* the first five tergites are divided longitudinally by a narrow strip of soft skin, the succeeding ones being entire; on a somewhat older specimen the first tergite is also undivided. In the young of *Pettalus brevicauda* figured on Pl. III., fig. 3 *g*, the six first tergites are divided, the first less distinctly than the others.

How very much the statements of even recent authors vary concerning the number of abdominal segments in *Phalangium*, the genus amongst Opiliones which is most numerously represented in Europe, will appear from the following data. In 1843 Tulk (p. 163) reckoned ten tergites, counting as he did, the last tergal plate of cephalothorax as belonging to abdomen, and interpreting operculum anale as an independent segment; at the same time, however, he only counted five sternites, which number apparently is the right one in this and allied genera. In 1872 Balbiani (Pl. I., fig. 6), on the contrary, counted only seven segments (tergites) on an almost mature embryo, with three thoracic ones, because he reckoned the first tergite of abdomen as belonging to cephalothorax (pp. 9—10), and quite overlooked operculum anale. In 1887 Weissenborn, simply following Tulk, stated the segments to be ten, whilst Bernard (p. 361) in 1894—1897 counted only six segments—a result which seems to us unintelligible, as he does not explain how he arrived at that number. The numbers which we have cited were, however, based merely on one-sided investigations of the genus *Phalangium*, which must be said to be the one in which it is more difficult than in any other to ascertain the number, at any rate of the sternites. In this respect those authors who attempted to solve the problem through a comparative study of a larger number of representatives of the order, were more favourably situated.

When Sörensen in 1873 (*a*) attempted a morphological interpretation of the structure of Opiliones, he came to the conclusion that abdomen in Palpatores and Laniatores consisted of eight segments, which result was essentially based on the number of tergites. He did not count operculum anale as a tergite because he missed the true view of the morphological

value of "corona analis" (woodcuts figs. *F—H*) in Nemastomatoidæ, and Troguloidæ¹. Thorell, on the contrary (*a* p. 458), unhesitatingly interpreted the "anal plate" in Laniatores and in the families Phalangioidæ and Ischyropsalidoidæ amongst Palpatores, as well as the hindmost piece in "corona analis" in Nemastomatoidæ and Troguloidæ, as a tergite, and accordingly counted nine abdominal segments in Laniatores and Palpatores, in which view he was followed by Simon (*b*, p. 118), though with some vacillation.

As, however, several difficulties have to be solved, particularly as regards the sternites in the order Opiliones generally, we have thought it well to subject the question to a thorough examination.

In the other orders of Arachnida, where the division of abdomen into segments is clearly to be seen, tergites and sternites are placed opposite each other so plainly that it is easy or, at any rate, not difficult, to see which sternite belongs to each of the tergites. But this is not the case in Opiliones where the sternites as a rule are not placed opposite the corresponding tergites, so that it is impossible to find out which sternites belong to each of the tergites without a comparative study of various animals. We shall therefore examine in order the different combinations which occur.

As regards Laniatores we may premise that we can speak with some confidence because one of us has studied these animals for many years, and is acquainted with a considerably larger number of them than have been described. Amongst the families of this sub-order the very remarkable one, Oncopodoidæ, established by Thorell, exhibits an arrangement different from what occurs in any of the other families. Cephalothorax coalesces here with the first eight² tergites of abdomen so as to form a dorsal shield on which the boundaries of the tergites are marked by transverse grooves, operculum anale only remains free and is situated on the under surface of the body; at the same time all the sternites are fixed into a ventral shield on which only six sternites, separated by shallow grooves, can be traced, and of which the last does not exhibit any trace of bisection. In all other Laniatores there are posteriorly three free tergites besides operculum anale; the latter is rather large whilst the three free tergites in front of it are rather short, and diminish in length gradually, but only a little, towards the posterior extremity of the body. On the dorsal shield in front of the free tergites five transverse grooves are generally distinguishable, of which the foremost, as already mentioned, marks the boundary between cephalothorax and abdomen. The latter groove is, as a rule, distinct, but this is not always the case with the others. It is curious that the fourth groove often disappears, although the others

¹ We refer to the table of the families of Palpatores with their characters which will be found at the conclusion of this part of our paper.

² That such is the case in *Oncopus* Thor. and *Gnomulus* Thor. is clear from Thorell's descriptions of these genera (*b*, p. 134 and *e*, p. 378), but we have no doubt that it is the case also with the only other genus yet described, belonging to this family, viz. *Pelitnus* Thor., although Thorell states in his description (*f*, p. 757) that the sixth and following tergites are free. Partly through the kindness of Professor Thorell we have been able to study both a representative of *Oncopus* and a specimen which we refer to *Pelitnus*, because it agrees in all respects with the definition of that genus given by Thorell, except that the arrangement of the

tergites is the same as in *Oncopus*. We believe that this difference is fully explained by the fact that the animal described by Thorell was not fully grown, as he expressly states (*f*, p. 758), whilst this is the case with the specimen examined by us. We therefore agree with Pocock (*b*, p. 283) in assuming that the adult *Pelitnus* has the same arrangement of the tergites as *Oncopus*. If this be so, Oncopodidae agree with Cyphophthalmi in this point, that the young animals do not have all the tergites fused together, whatever be the case with the sternites. By the courtesy of Professor Thorell one of us has had an opportunity of seeing a not fully grown *Oncopus Feæ* Thor. in which the eight tergites had already coalesced with each other and with cephalothorax.

are well marked¹. That it is the fourth which thus disappears is evident from the fact of its being present, though slightly indicated, in congeners of the animal in question, in which case the area behind it (the fourth tergite) always is much smaller than the preceding one. The area which is cut off by the last (fifth) groove is often very small, and Sørensen (*b*, p. 126) did not consider that it represented a real tergite, but thought that it was only the posterior margin (limbus posterior) of the dorsal shield. Thorell, on the contrary, considered it to be a real tergite, and the justness of this view appears indisputably from the fact that in some abnormally developed specimens of a still undescribed species, where the posterior areae of the dorsal shield were separated from each other by strips of soft skin, such an one was found also between "limbus posterior" and the preceding (fourth) tergite. It will be seen that in all divisions of Laniatores, eight tergites can be accounted for besides operculum anale.

On the ventral surface Laniatores (with the exception already mentioned, of Oncopodoidæ) exhibit apparently only six sternites (woodcut fig. *K*). Of these the "first" coalesces with the fourth pair of coxae, which are often very much expanded; but the following sternites are free. It is also worthy of attention that the following four sternites always are considerably shorter, not only than the "first," but also than the last or "sixth," and that the latter almost always exhibits a transverse impression or very shallow groove, which clearly indicates that it is really formed by the coalescence of two sternites—a conclusion which is confirmed by the fact, that each of the two parts separated by the said transverse groove generally carries a row of granulations, just as is usually the case with each of the preceding four free sternites. On the "first" sternite a transverse groove is found behind the spiracles, in the same place where the weaker transverse impression is found in Cyphophthalmi. This groove, which extends nearly across the whole sternite, varies very much as regards distinctness, being sometimes very strongly marked, in others less so, in others again scarcely visible. The portion of the "first" sternite which is situated behind this groove shows almost always a row of granulations, whilst these are scattered over the surface of the anterior part. Nor can we doubt that this groove marks the boundary between two sternites. In this way we are able to account for eight sternites in Laniatores, to begin with. In all Laniatores the foremost sternite always carries at its anterior extremity a small operculum genitale (*r*), which is movable and always able to close the genital orifice completely.

In Palpatores there are always eight clearly distinguishable tergites besides operculum anale. Except in Ischyropsalidoidæ² and the Gagrellini above mentioned³, at least⁴ the five first tergites of abdomen are fused with the upper surface of cephalothorax so as to form a dorsal shield, whilst as a rule the three posterior ones besides operculum anale are free. In Troguloidæ, Nemastomatoidæ, and *Sclerosoma* Luc. with allied genera (Sclerosomatini E. S.), all of which comprise species with hard integuments, the three posterior tergites (besides operculum anale) are always free⁵. In *Phalangium* and allied genera, of which the majority of species have more or less soft integuments, the three posterior tergites, besides operculum

¹ The family Pachyloidæ W. S. which for this reason was separated from Gonyleptoidæ cannot therefore be maintained as such.

² See above, pp. 5—6.

³ See above, p. 5, note 1.

⁴ Thorell's statement (*a*, pp. 465—467) that in *Ischyrop-*

alis and *Nemastoma* four to five free tergites are met with (counting operculum anale as an independent tergite) is not correct.

⁵ It is an error when Thorell states (*a*, pp. 465—467) that two to four dorsal plates are free in *Sclerosoma*, *Trogulus* and *Anelasmococephalus*.

anale, are likewise as a rule free, but their movability decreases towards the fore end so that very frequently the sixth tergite cannot be said to be capable of free movement against the fifth. This is the case even in some species of Gagrellini, which have hard skin. And the sixth and seventh tergites are even fused with the dorsal shield in *Melanopa tristis* Thor. as well as in a probably undescribed form from California in the Museum of Copenhagen, which approaches nearly to the genus *Egaenus* C. L. Koch and possesses rather hard integument. We have already mentioned that all the tergites are free in both sexes of *Ischyropsalis Mülleri* and, according to Simon, in the male of *I. nodifera* E. S. It remains to be added that in *Sclerosoma* and allied genera the three last tergites (not counting operculum anale) are bent downwards on to the under surface of the body (woodcut fig. *E*), in such a way that the fifth tergite forms a rather sharp corner with the succeeding one, and appears to terminate the body, when viewed from above. In Troguloidæ the same is the case with the two last tergites (not counting operculum anale), and the sixth tergite is apparently the last. In *Phalangium* and allied genera and in Ischyropsalidoidæ, the posterior extremity of abdomen is, on the contrary, gently rounded down, so that only operculum anale can be said to be placed positively on the ventral side (woodcuts figs. *C* and *D*). In this respect Nemastomatoidæ occupy an intermediate position, the three last tergites (besides operculum anale) being bent downward, when the body is not distended by food or eggs.

Whilst thus the number of tergites in abdomen is very constant in Palpatores, this is well known not to be the case as regards the sternites; because the "corona analis," which is well developed in Nemastomatoidæ and Troguloidæ (woodcuts figs. *F*, *G*, *H*), is either absent or much reduced in Ischyropsalidoidæ and Phalangioidæ. Apart from this difference it may be said, at any rate if we follow the statements hitherto published, that all Palpatores possess five distinct sternites, even though these may be separated from each other only by folds of the skin, such as is frequently the case in species of Phalangioidæ which have soft skin. The sternite, which according to this view would be called the first, extends more or less far between the coxae and terminates in an operculum genitale, which always closes the genital orifice. Operculum genitale (*r*) is of somewhat different shape in different groups. In Phalangioidæ (woodcuts figs. *A*, *D*, and *E*) it is very large, its posterior extremity being not far from the posterior margin of the "first" sternite, to which it belongs, whilst its lateral margins are slightly concave in the greater part of their extent; in those with hard skin, as in *Gagrella*, *Sclerosoma* and genera allied to them, it is sharply separated from the rest of the sternite by soft connecting skin; in *Phalangium* and congeners, where the general integument is soft, operculum genitale is likewise separated from the sternite, but not so conspicuously. This difference, which in itself is of little consequence, has caused Simon (*b*, p. 158) to reckon six sternites in *Sclerosoma* and allied genera, but only five in those whose skin is softer, he having mistaken the soft connecting membrane between operculum genitale and the rest of the sternite in the hard-skinned genera, for a boundary between two sternites. In *Ischyropsalis*, Nemastomatoidæ and Dicranolasmatini (a group of Troguloidæ) operculum genitale is on the contrary small, its posterior margin being situated far forward near the anterior extremity of the fourth pair of coxae. Its lateral margin is convex both in the genera mentioned and in Trogulini (woodcut fig. *F*) where it is very small, and so short that in both sexes it is several times as broad as it is long.

It is, however, always possible to show that this foremost sternite really consists of two sternites fused together. Immediately behind each of those grooves which separate the

five unmistakable sternites in Trogulini there is a pair of impressions, corresponding to protuberances on the inside for the attachment of muscles, and which consequently mark the limits between sternites just as well as the grooves. But a pair of such impressions are also found on the foremost sternite, nearly in the middle of it, and at a considerable distance from operculum genitale. These impressions are seen particularly well in *Anelasmocephalus*, especially in *A. lycosinus* W. S. (*u*, woodcut fig. F). In *Trogulus* they are not so distinctly marked except the two first pairs, on the middle of the foremost sternite and behind the anterior margin of the second. In Dicranolasmatini a more or less sharply defined groove is found far behind operculum genitale extending across the foremost sternite, and behind it two generally weak impressions of broadly triangular shape; this groove is especially sharp in *Amopaum Sörensenii* Thor. In *Nemastoma*, no distinct groove can be traced across the foremost sternite; but, far behind operculum genitale, two, usually deep, triangular impressions are found. In Phalangioidæ finally a generally shallow groove extends across¹ the foremost sternite close behind the base of operculum genitale, which is here very long; immediately behind the groove a pair of generally slight impressions are noticeable (*u* in woodcut fig. A)². We conclude that immediately in front of them, or along this transverse groove, lies a boundary line between two sternites, showing that the sternite which authors describe as the first consists of two. It is also well worth noting that the distance, between the posterior margin of the so-called first sternite and the groove or the pair of impressions which indicate the boundary between the two sternites of which the so-called first sternite consists, is always constant, being equal or nearly equal to the length of the smaller second sternite, whilst the distance between the groove and the base of operculum genitale varies according to the size of the latter, as we have already indicated.

One more feature in connection with this so-called first sternite craves our attention. In both sexes of *Sclerosoma*, in the female³ of *Mastobunus tuberculifer* Luc., and in the female of *Astrobumus Kochii*⁴ Thor. as well as in the females of several species of *Gagrella*⁵, the sternites are divided into a larger middle piece and two smaller lateral pieces, which in *Sclerosoma* have a backwards slanting position. But where this feature occurs there are five pairs of such lateral pieces corresponding to the four first sternites (woodcuts figs. C, D, E), and the position of the foremost pair of these lateral pieces leaves no doubt as to their belonging to the anterior portion of the so-called first sternite; in those species moreover, in which we have been able to ascertain the position of the spiracles⁶, these are always situated opposite this lateral piece⁷, or on, or opposite⁸ the anterior portion of that part

¹ In some cases, as in *Leiobunum*, particularly *L. rotundum* Latr., the groove does not extend quite across the whole sternite, but is visible only in the middle, and even there sometimes not clearly.

² These impressions are sometimes so weak as to be scarcely visible, as in the genera allied to *Sclerosoma*. As a rule those near the anterior border of the so-called second to fifth sternites are difficult to distinguish, but in *Leiobunum*, particularly *L. rotundum* Latr. and in *Gagrella chaetopus* Thor., they are very distinct.

³ The male has only two pairs of lateral pieces which flank the "first" sternite.

⁴ The only species of this genus with which we are acquainted. The male is not known to us.

⁵ Thus in *G. Feei* Thor., *G. chaetopus* Thor., *G. minax* Thor. and *G. sordidata* Thor.

⁶ These represent all the families of the suborder Palpatores.

⁷ In some Gagrellini, as in *G. sordidata* Thor. ♂ and in *Melanopa* Thor., only one pair of lateral pieces is found, which corresponds to the foremost pair, where there are more.

⁸ In *Nemastoma (lugubre* O. F. Müller) the spiracles are situated on a long piece of chitin in the posterior wall of the groove which separates the fourth coxa from abdomen; and here too the spiracles are placed opposite the foremost of the parts mentioned as belonging to the so-called first sternite. In *Gagrella minax* Thor. each of the large spiracles is likewise placed in a strongly chitinized piece of the posterior wall of the groove, between the fourth coxa and abdomen, which together with another smaller one, distally placed in relation to it, corresponds to the one piece in *Nemastoma*.

of the so-called first sternite which we have been discussing, that is, in the same place as in Cyphophthalmi and Laniatores. These facts throw light also on the structure of Cyphophthalmi. We mentioned above (p. 12) in this chapter that in young animals of that group the spiracles are placed on a pair of lateral pieces of chitine which are separated from the surrounding parts by soft skin (Pl. II., fig. 3 *h*; Pl. III., fig. 4 *c*), and these correspond evidently to the foremost pair of lateral pieces in the species above mentioned of *Gagrella*, *Sclerosoma* and allied genera. In the adult Cyphophthalmi, moreover, the foremost of the oblique grooves sweep forward along the inner side of the spiracles¹, which means that here the separation between the anterior pair of lateral pieces of the so-called first sternite and the surrounding parts, remains longer than the separation between the two sternites of which the so-called first sternite is composed.

In speaking of how many sternites we have been able to account for, we have hitherto treated the numbers which we have made use of as merely preliminary, because in all divisions of Opiliones we can account for one sternite more, the true first sternite, which is represented by what we have called "arculi genitales" (*m* on the woodcuts). These are found in all members of the order, often easily observed, or even of considerable size, though in a large number of cases only a small part of them preserves so much independence that it can be demonstrated.

In Phalangioidæ with soft integuments, as in *Phalangium*, we meet with a peculiar feature which hitherto has received but little attention and remained without an explanation, viz. that though the fourth pair of coxae are separated from abdomen in the greater part of their extent by the groove in the posterior wall of which the spiracles are situated, they are nevertheless, if we may say so, intimately united to abdomen at their proximal extremity along the lateral margin of operculum genitale (woodcut fig. *A*); anteriorly this apparent part (*m*) of the coxa is continued as a narrow band along the proximal extremity of the third pair of coxae, towards, or even reaching, the anterior extremity of operculum genitale.

This peculiar arrangement by which the fourth pair of coxae is rendered less movable than the others has of course been noticed by earlier observers², but it does not appear to have received the attention it deserves³.

In Phalangioidæ with harder integuments, as in *Sclerosoma* (woodcut fig. *E*) and in *Gagrella* (woodcut fig. *D*) with its congeners, the same arrangement exists, but this continuation or apparent inner portion of the fourth coxa is separated by a groove, a suture or a strip of soft skin, not only from the part of abdomen which lies behind it, but also from that part of the coxa which is separated from abdomen by the deep groove, in the posterior wall of which the spiracles are situated. In all Cyphophthalmi with which we are acquainted the same structure is met with: operculum genitale is literally framed by a pair of pieces

¹ It must be borne in mind that in Cyphophthalmi the spiracles are in an uncovered position on the ventral surface, not placed in a groove between the fourth coxa and abdomen as they are in the majority of Palpatores, for instance in all Phalangioidæ.

² It is for instance represented, though not quite true to nature, in one of Treviranus' figures of *Phalangium parietinum* De Geer (Pl. II., fig. 11); Simon too shows it in

Phalangium Opilio L. (*b*, Pl. XXI., fig. 3) and *Sclerosoma quadridentatum* Cuv. (*ibid.* fig. 9).

³ Sørensen had noticed it in 1873, but was unable to arrive at an explanation of it, because at that time the Museum at Copenhagen was rather poor in Phalangioidæ with hard integuments, and did not possess any Cyphophthalmi at all.

of hard chitine, "arculi genitales" (*m* in several figures)¹, which are always separated from abdomen by a groove-like suture, whilst they are separated from the fourth pair of coxae by a more or less distinct, often partly quite indistinct, linear impression which is generally deep, but in *Ogovia* (Pl. III., fig. 1 *d*) is so slight that it is not possible to indicate the boundary between the coxae and "arculi genitales" with any certainty. A comparison between the structure in these different groups clearly shows that what appears to be the proximal extremity of the fourth coxa really is the same piece as the "arculi genitales" in Cyphophthalmi, and is not a typical part of the coxa at all. In Cyphophthalmi the genital orifice is not closed by operculum genitale and it is therefore easy in their case, without any preparation, to see that the "arculi" turn inwards, on a level with the posterior margin of the third pair of coxae, and meet in the middle line of the body where, as a rule, they are separated from each other by a furrow, in front of the genital orifice (especially plainly seen on Pl. III., figs. 2 *f* and 3 *c*). In this way the "arculi" enclose this opening on the sides, in front, and at least anteriorly above. The morphological value of these "arculi genitales" is most easily recognized in a not full-grown animal of Cyphophthalmi, for instance *Stylocellus sulcatus* n. sp. (Pl. II., fig. 3 *h*) or *Purcellia illustrans* (Pl. III., fig. 4 *c*). In this stage of development the orifice itself does not exist, but the development of operculum genitale has commenced; in front of which, and partly at either side of it, a flat and rather large area appears, the shape and position of which clearly indicate that it belongs to abdomen. From the rest of the latter it is separated by a strip of thinner skin, which is continued across the body behind the small beginning of operculum genitale. The small lateral protuberances which are seen on this area and have the character of incomplete replicas of those which are found in the adult animal, clearly show that it is the "arculi genitales" that are formed in this area.

It follows that "arculi genitales" represent the real first sternite. We would point out that this result confirms the correctness as regards Opiliones of our statement on an earlier occasion in treating of Palpigradi (*a*, p. 232): "As usual in those Arachnida whose anterior segments can be distinguished from each other, the second is the genital one, viz. the one in which the genital organs have their orifice." We were unable at the time to prove the correctness of this view in the case of Opiliones, but we believe that one of us² has demonstrated it as regards most of the other orders of Arachnida, in opposition to the view held by other authors, that the genital segment is the first.

As arculi genitales in Cyphophthalmi offer characters by which the sexes can be distinguished, we shall have to return to them again in our chapter on the external sexual characters. In this place we will deal with the arculi of the two other sub-orders. Where operculum genitale is removed in Phalangioidæ a transverse piece will be seen (woodcut fig. *B*), which before was hidden or nearly hidden by operculum genitale, and which anteriorly forms the roof of the genital orifice. The posterior, smaller portion of this piece consists of a firmly chitinized transverse strip which in some cases, for instance in *Phalangium*, gradually merges into the anterior lobe of the lateral arculi (from *m* in woodcut fig. *B*, a long dotted

¹ Being so conspicuous, particularly in the larger species of Cyphophthalmi, they have of course not escaped the notice of Thorell (*c*) when he described the genital orifice, but he neither gave them any name, nor proposed any explanation of them (*c*, pp. 26, 27). Pocock described them (*b*, p. 291) as "pregenital coxal lobes of the fourth legs," a

description which is correct in so far that they really are pregenital, but otherwise is less fortunate, because lobi coxaes, properly speaking, is a formation which does not occur in any Arachnidæ either on the third or the fourth pair of legs.

² Sörensen, *f.*

line projects to the transverse strip and a shorter line to the lateral free part of the arculi), but in *Gagrella* and *Sclerosoma* is separated from them by a narrow groove with soft skin, into which the lateral margin of the apex of operculum genitale fits when the opening is closed. From this strip the other portion (*n*) of the transverse piece extends forwards and downwards as a perfectly free projecting lamina which entirely hides that part of sternum which cannot be reckoned as forming the labium¹. Hidden by this free portion of the transverse piece a narrow strip of soft skin is found between its front basal margin and sternum. The anterior border of the piece is sometimes rather convex (*Gagrella minax* Thor.), in other cases rather emarginate in the middle, as in *Phalangium*. To us it is beyond doubt that this hard transverse strip with its appended free lamina is not at all, as Simon thinks (*b*, Pl. XXI., fig. 4), the sternum², but that it corresponds to the inward bent ends of arculi genitales in *Cyphophthalmi*. The correctness of this view is confirmed by the structure in *Ischyropsalis*. It is true that in this genus arculi genitales do not appear as a separate portion of the fourth coxa; but under and partly in front of the anterior extremity of operculum genitale there is a rather short hard transverse piece, of which the anterior margin is thicker than the rest; it is not expanded into a freely projecting lamina as it is in Phalangioideæ, but, like the corresponding piece in that family, it is separated from sternum by a groove with soft skin; at the lateral corner the transverse piece is bent backwards, and continued on either side as a rather narrow strip under the lateral margin of operculum genitale, along the fourth coxa with which it is fused. In *Nemastoma* and *Trogulus* arculi genitales are likewise invisible outside operculum genitale. In *Nemastoma* a nearly square piece is found between the first pair of coxae from the posterior margin of which a pair of strips extend backwards along the proximal ends of the three posterior pairs of coxae, with which it is connected by thinner though well chitinized skin. We look upon this square piece with its two continuations as representing sternum and arculi genitales together; labium being, as before mentioned, separated from sternum by quite soft skin. In *Trogulus* (woodcut fig. I) the structure is the same as in *Nemastoma* in all respects except that the plate formed by the coalescence of sternum and arculi is triangular and proportionally larger, so that its posterior margin is situated a little behind the proximal extremity of the third coxa. In *Trogulus* the lower interior margin of the fourth coxa terminates in a small lobe, which in part projects independently and is situated inside and in front of the proximal end of the third coxa; this lobe recalls the lobe-like anterior corner of that part of arculi genitales which in Phalangioideæ is visible outside operculum genitale, and the fact points to the conclusion that the interior margin of the fourth coxae also in *Trogulus* morphologically belongs to arculi genitales³.

In Laniatores arculi genitales are very inconspicuous; all that as a rule can be seen of them is a slightly curved low chitinous ridge to which operculum genitale fits, when the latter is closed, as a lid to a box, whereby the ridge is quite hidden from sight. Like arculi

¹ See our statements on this subject above (p. 8) in treating of sternum.

² We can only suppose that Simon did not perceive the true sternum itself.

³ Pocock, in his recently published paper on the Morphology and Classification of the Opiliones (*d*), attributes great weight to the structure of sternum in Palpatores. It cannot be chargeable against him that he did not arrive at the right conception of our "arculi genitales," of which his "second

sternal plate" is the front part, as belonging to the abdomen, because their real nature cannot be seen without a close comparative study of the whole sub-order Palpatores together with Cyphophthalmi. But in consequence he, for instance, did not see the real sternum in Phalangioideæ, which is concealed by his "second sternal plate" (Pl. IX., fig. 1A "st 2"). A further consequence of the last-named fact is that he did not apprehend the real differences in this region between the different groups of Palpatores.

genitales in Cyphophthalmi, the ridge in question in Laniatores is sharply divided off from sternum by a suture. In some specimens only of *Phalangodes Piochardi* E. S. we have noticed a slanting groove across the proximal portion of the fourth coxa, as in some Cyphophthalmi; but it is placed farther from the base of the coxa than in any representative of that sub-order.

We are thus enabled by a comparative study of representatives of all the families comprised in the order Opiliones, to demonstrate that the apparently "five" first sternites—the only ones visible in Phalangioidæ—in fact represent seven sternites, of which the first, the arcu genitales, embraces the genital orifice laterally and in front, whilst the second carries the spiracles and bounds the genital orifice behind, operculum genitale being in reality only a continuation of this sternite in a forward direction. The true third sternite is in all Opiliones immovably united in the second one.

The morphological interpretation of the posterior extremity of abdomen is attended with much more difficulty than that of the base, on account of the rather considerable difference in regard to that part between the principal types of Opiliones. In Laniatores (excepting Oncopodoidæ) we find behind the true seventh sternite another large sternite (woodcut fig. *K*) which, as we have already mentioned, evidently is made up of two. The same is the case in Cyphophthalmi (Pl. I., fig. 10) with the unimportant difference that in the latter case they are small. In both these sub-orders nine sternites can thus be accounted for. Amongst Palpatores a "corona analis" is found in Nemastomatoïdæ and Troguloidæ; but in Phalangioidæ and Ischyropsalidoidæ only insignificant vestiges, or none at all, of such an arrangement are to be found. In Cyphophthalmi we find besides a ninth tergite situated behind, that is to say, above operculum anale, but this tergite is wanting, at least apparently, in the other sub-orders. It must be considered as absolutely beyond question that this ninth tergite belongs to the same abdominal segment as the ventral segment which we describe as the true ninth.

In those Palpatores where "corona analis" is well developed it consists, as is well known, of four chitinized pieces, one ventral piece, placed in the middle in front of anus, a dorsal piece behind anus, and a pair of lateral ones (woodcuts figs. *F*, *G*, *H*). There can be no doubt of the dorsal piece being operculum anale, and this is acknowledged by all authors. As regards the lateral pieces, the following views have been propounded: in 1876 Thorell (*a*, p. 458) says "The ventral [median] and the two lateral ones together seem to represent the two last typical [ventral] segments, the eighth and the ninth." Simon (*b*, p. 119) considers that they belong to one and the same sternite, which he considers to be the last, viz. his sixth; finally Hansen (*a*, p. 494) has advanced the view, that the lateral pieces and operculum anale belong to each other. We cannot adopt any of these views. That the median ventral piece belongs to the ventral surface of the body cannot be doubted; but that is not the case with the lateral pieces. A careful examination of certain forms such as *Nemastoma* and *Anelasmacephalus* (woodcuts figs. *H* and *G*) reveals that the posterior part of the median piece—which is not visible unless the operculum anale is lifted up—is separated from the anterior portion by a transverse groove, which indicates that the piece in question is formed by the union of two sternites. The posterior of these sternites is, even when comparatively large, very small, and fused with the preceding one, and in some forms it is not traceable. The lateral pieces of "corona analis" extend upwards between operculum anale and the eighth tergite. If now we compare the anal region of a *Nemastoma* or a Troguloid form (woodcuts *H* and *G*) with that of some representative of the sub-order Cyphophthalmi, for

instance *Stylocellus* (Pl. I., fig. 10), we shall see clearly that the lateral pieces in the first-named genera occupy the same position as the small tergite in Cyphophthalmi, the only difference being that they do not meet in the middle line. We cannot therefore adopt any other view than that the lateral pieces of "corona analis," in those Palpatores where such an arrangement is found, represent the ninth tergite, of which the middle portion has remained soft. This tergite is accordingly traceable only in Cyphophthalmi and in those Palpatores which possess a "corona analis" fully or partially developed, but has altogether disappeared as a chitinized piece in the other Palpatores and in all Laniatores.

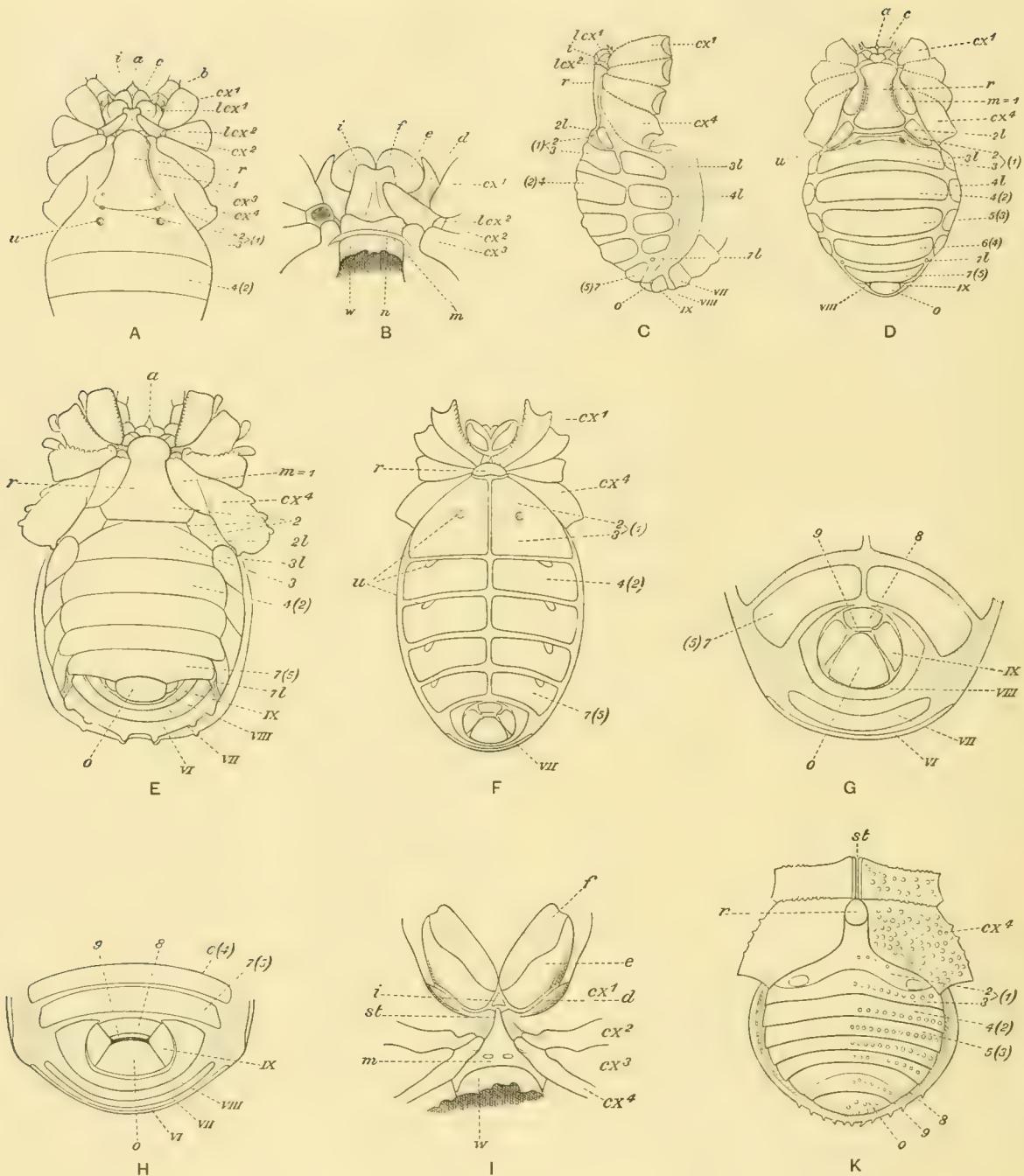
In Phalangiodæ a fully developed "corona analis" proper is not met with, but in some cases there are nevertheless rudiments of it present. The least rudimentary "corona analis" is found in *Sclerosoma* and allied genera, where Simon has already pointed out (b, p. 158) the lateral pieces, and laid some stress on their presence as affording a character of his sub-family Sclerosomatinae, which, however, in our opinion is not tenable with the restriction proposed by him. But the median ventral piece is also present in these genera as a firmly chitinized, short but proportionally broad plate, which is fully movably connected with the preceding seventh, so-called fifth, sternite, and quite reaches the lateral pieces of "corona analis"; this small median piece is, however, not visible unless operculum anale is lifted up. *Gagrella* Stol. and allied genera are, in our opinion, nearly related to *Sclerosoma* and congeners, and in this view we are confirmed by the fact that "corona analis" can be traced, though in a still more rudimentary state, in at least some species of *Gagrella*. In *G. minax* Thor. (woodcuts figs. C and D) the lateral pieces of "corona analis" are represented by a pair of very small triangular pieces, and when operculum anale is lifted up, the median ventral piece is likewise to be seen in the shape of a very small plate, because it is firmly chitinized in this species. The lateral pieces are traceable also in some other species of *Gagrella*, but we have been unable to discern the median ventral piece in any of the other species in which we have sought for it.—In all other genera of Phalangiodæ both the lateral and the median ventral pieces of "corona analis" have completely disappeared¹. As regards *Ischyropsalis* and allied forms we shall speak below.

We then come to the interpretation of the chitinous parts described and the general question as to how many segments abdomen is composed of in Opiliones.

Above we proved that in Cyphophthalmi the abdomen consists of nine complete segments besides operculum anale; as to the latter we follow the interpretation of Thorell, considering the operculum to be the dorsal part of a terminal segment, the ventral part of which has disappeared. In Laniatores generally (Oncopodoidæ excepted) we pointed out nine abdominal sternites as in Cyphophthalmi, but besides operculum anale we were not able to discover more than eight tergites; nine sternites being present, the abdomen must in this sub-order be composed of ten segments, but the ninth tergite has disappeared. In the two families of Palpatores with "corona analis" well developed we find ten distinct segments. Above we proved that all Palpatores have eight tergites and seven sternites, to which either operculum anale or a "corona analis" must be added. In Nemastomatoidæ and Troguloidæ, the lateral pieces of "corona analis" are the rudiments of the ninth tergite, the anterior ventral plate of "corona"

¹ In order to avoid misunderstanding we may add that we do not mean to convey that those pieces have disappeared otherwise than as chitinized pieces, because during the development of the embryo, the segments are always formed by

degrees, proceeding from the anterior to the posterior extremity of the body, so that the hindmost portion of the body, which is not farther divided into segments, remains as the anal segment.



The lettering is uniform throughout all woodcuts.

a. labrum; b. mandibular palp; c. mandible; cx¹-cx⁴. coxae of the first to fourth pairs; d. proximal chitinized part of the maxillary lobe of the first pair of coxae; e. more distal chitinized part of the maxillary lobe of the first pair of coxae; f. distal thin-skinned part of the maxillary lobe of the first pair of coxae; i. labium; lcx¹. maxillary lobe of the first pair of coxae; lcx². maxillary lobe of the second pair of coxae; m. arculi genitales; n. transverse free plate protruding—in Phalangioidea—from the front part of arculi genitales; o. operculum anale; r. operculum genitale; st. sternum; u. muscular impression; w. upper wall of the genital opening, normally covered by operculum genitale; 1—9. first—ninth abdominal sternite; (1), (2)...(5). the numbering of the abdominal sternites according to earlier authors; 2l, 3l...7l. lateral pieces of second to seventh abdominal sternites; VII—IX. seventh to ninth abdominal tergite.

FIG. A. *Phalangium cornutum* L., body of the female, excepting its posterior portion, from below; $\times 6$.

FIG. B. *Phalangium cornutum* L., ventral surface of cephalothorax, from below, $\times 12$; only the proximal parts of coxae are shown, mandibles omitted, maxillary lobe of the second pair of coxae on the left side and operculum genitale removed.

FIG. C. *Gagrella minax* Thor., body of the female, from the side, $\times 6$; the upper half of cephalothorax and of the major part of abdomen omitted.

FIG. D. *Gagrella minax* Thor., body of the female, from below, $\times 6$.

FIG. E. *Sclerosoma monoceros* C. Koch, body of the male, from below; $\times 14$.

FIG. F. *Anelasmococephalus lycosinus* W. S., body of the male, from below, $\times 24$.

FIG. G. *Anelasmococephalus lycosinus* W. S., posterior part of abdomen of the male, from below and somewhat from behind, $\times 39$; operculum anale is lifted up a little.

FIG. H. *Nemastoma lugubre* O. F. Müller, posterior part of abdomen of the female, from below and somewhat from behind, $\times 20$; operculum anale is lifted up a little.

FIG. I. *Trogulus rostratus* Latr., middle portion of the ventral surface of cephalothorax, from below, $\times 13$; of the coxae only the proximal part is shown, mandibles are omitted and second abdominal sternite with operculum genitale removed.

FIG. K. *Bupares caper* Thor., body of the male, excepting the two anterior pairs of coxae and mandibles, from below; $\times 12$.

is often divided into a large anterior and a small posterior part by a transverse more or less distinct groove, these two parts are the eighth and the ninth sternites coalesced with each other as in Cyphophthalmi. In this way the two families in question possess nine complete segments, to which operculum anale must be added as the tenth segment. In *Sclerosoma* and congeners the same elements can be traced as rudiments, with exception of the ninth sternite; in some species of *Gagrella* we found a transition stage to *Phalangium* and allied genera, in which the ninth tergite and the eighth and ninth sternite have completely disappeared.

Finally we may say some words on the structure of the posterior part of abdomen in the family Ischyropsalidoidæ. In *Ischyropsalis* C. L. Koch, the lateral pieces of "corona analis" are always distinct, as indeed Thorell has already pointed out (*a*, p. 458). In most of the species with which we are acquainted the median ventral piece is not developed, but is found in *I. dispar* E. S. in the shape of a rather narrow and short, chitinized strip extending between the two lateral pieces. In *I. Müller* there is a piece behind the seventh sternite which reaches laterally as far as the latter; the middle portion of it, in front of operculum anale, is quite short, but on either side of operculum anale it shows a considerable expansion backwards; the extreme lateral portion is again quite short. We are of the opinion that this piece behind the seventh sternite corresponds to the three pieces of "corona analis," in other words, that this piece is formed by the fusion of the ninth tergite with the eighth sternite, from the latter of which a ninth sternite is not marked off. We may remind the reader that a rather similar fusion of the same parts is found in *Ogovia* n. gen. and *Siro* Latr. of the

sub-order Cyphophthalmi. In *Taracus* E. S., *Tomicomerus* Pav., *Sabacon* E. S. and *Parasabacon* n. gen., there is behind the seventh sternite a well-developed plate which on the sides is united to the eighth tergite. In *Taracus* this plate is besides in the middle fixed with the seventh sternite, but on the sides it is separated from it by means of connecting skin. We look upon this plate as formed—as in the other genera—by the fusion of the anterior ventral piece with the lateral pieces of “corona analis.”

The result to which we thus have arrived is very different from the opinion set forth by Weissenborn (pp. 69, 70). “Tulk,” says he, “counted ten dorsal arcs in *Opilio Phalangium*, but only five ventral ones, separated by transverse grooves; to which, however, sternum [operculum genitale] must be added, which he reckoned as part of thorax. The latter represents evidently¹ the coalesced sternal arcs of the first five dorsal arcs, and carries the genital orifice at its anterior margin.” But Weissenborn knows evidently only the one genus *Phalangium*² out of the whole order Opiliones, which is rather rich in forms, differing considerably from each other, nor is he acquainted with the various publications, which treat of the morphology of Opiliones, not even Simon’s “Les Arachnides de France,” which is so generally consulted. Indeed he cannot fairly be said to know *Phalangium* or the writers to which he refers, Tulk and Balbiani. Had he really known them, he could scarcely have failed to understand that the two tergites—the last thoracic and the first abdominal one,—which Tulk describes as the two first tergites of abdomen, were reckoned by Balbiani as belonging to thorax, which according to this view would have three separate segments bearing limbs. That Weissenborn has not realised this is clear from his utterances with reference to Balbiani, just before the passage quoted, viz.: “This observation is nevertheless extremely interesting and important because it shows that the Phalangides, at a certain embryonic stage, exhibit a segmentation of cephalothorax, which is found permanently in Solpugidæ, and that they consequently pass through a Solpugidæ-like stage in the course of their development.” Since this was written, a deviating opinion on the number of abdominal segments has been advanced; we do not, however, believe it necessary to disprove it, thinking that our own view is solidly grounded.

4. The Limbs.

Antennæ (chelicerae) (Pl. I., figs. 1*f*—1*g*; Pl. IV., fig. 1*c*) consist in Cyphophthalmi as in all Opiliones of three joints³. They are rather long, longer than in Laniatores and in the majority of Palpatores⁴. The basal joint, particularly the proximal half of it, is quadrangular, prismatic, and somewhat compressed. The inner side is as a rule fairly plane in part, and forms most generally sharp corners with the adjoining sides, whilst the under side offers a somewhat different appearance, and the upper and outer sides form rather rounded corners between them. The upper side exhibits a transverse ridge in the middle or a little behind the middle (Pl. I., fig. 1*f*, *d*), which shows just in front of the edge of cephalothorax; it is

¹ Italicised by us.

² Besides which he professes to be acquainted with “die Cyphophthalmiden,” through the treatises of Joseph and Stecker.

³ We do not propose here to treat of antennæ in Laniatores and Palpatores, because we have no new information of

importance to communicate on the subject.

⁴ Some genera of these latter possess long or even very long antennæ, such as the male of *Rhampsinitus* E. S. (which is said to be nearly allied to *Acantholophus*), *Ischyropsalis*, *Macropsalis* W. S. and *Pantopsalis* E. S., in which latter genus they are several times longer than the body.

absent only in the genus *Siro* (Pl. V., fig. 1 *c*). On the outer edge of the under surface a process is found (our "processus inferior exterior") (Pl. I., fig. 1 *f*, *c*) which varies in shape, being sometimes more conical, in other cases rather compressed; it is connected with the ridge on the dorsal side by means of a low transverse ridge on the outer side. In *Pettalus cimiciformis* Cambr. (Pl. III., fig. 2 *b*) processus inferior exterior is very little developed, and it is wanting in *Ogovia* (Pl. II., fig. 6 *a*). The under surface of the basal joint generally carries a conical rounded process near the base (our "processus basalis") (Pl. I., fig. 1 *f*, *b*), which being thick occupies nearly the whole width of the under side (Pl. III., fig. 3 *c*). This is not found in *Siro*, *Ogovia*, and *Parasiro*. As we have mentioned before, the basal portion of the first joint is more or less hidden by the anterior edge of cephalothorax, which often projects in the shape of a collar. On the inner side the base of the first joint exhibits a proportionately large triangular prolongation (Pl. I., fig. 1 *f*, *a*), to the posterior corner and along the posterior margin of which the lowering muscle (m^1) of antennæ is fixed; from this line it extends forwards and upwards in a slanting direction, and works consequently at a very favourable angle. The lifting muscle of antennæ (m^2), which is much weaker, is fixed to the uppermost corner of the base of this prolongation and stretches from that point backwards, almost horizontally¹. The membrane connecting antennæ and cephalothorax forms a fold round the triangular prolongation of the basal point.

In accordance with the great length of antennæ their second joint forms a rather acute angle with the first joint when at rest. The statement of Joseph in speaking of *Siro duricorius* (*a*, p. 247), "when excited it stretched the chelicerae straight out, with the fingers spread..." implies that the animal is able to straighten its antennæ entirely. The second joint varies not a little in shape. In those genera which, like *Siro* (Pl. V., figs. 1 *c* and 1 *d*) and especially *Parasiro* (Pl. V., figs. 2 *b* and 2 *c*), have less elongated antennæ, the second joint is nearly fusiform, and the thickest point of it is on the distal side of the middle; but where antennæ are long and slender, as in *Stylocellus* and *Pettalus* (Pl. I.—III., several figures), the joint is less distinctly fusiform and has its greatest thickness at a point clearly on the proximal side of the middle.

We also notice a certain correlation between the width of stomotheca and the shape of antennæ. In all Cyphophthalmi the apical portion of antennæ when at rest is drawn into stomotheca, which accordingly is broader, when the apical portion of antennæ is comparatively robust, than when this is slender. The chela formed by the third joint in conjunction with the prolongation of the second joint is considerably shorter and more slender in those which have slender antennæ than where these are more robust; the edges of the branches of the chela, which are opposed to each other, are armed with a row of teeth, of which the number and shape differ in different genera.

Mandibulæ (maxillæ auctorum) (Pl. I., figs. 1 *i*—1 *k*¹; Pl. IV., fig. 1 *f*—1 *g*; Pl. V., fig. 1 *f*).

The basal joint of the second pair of limbs forms the mandibles as in all Arachnida, where such are found². It consists of two distinct portions, a basal pars palpigera (Pl. I., fig. 1 *j*, *p*), and an apical pars mandibularis (*m*). Of the latter we shall speak in treating of the structure of the mouth. The pars palpigera is prolonged into a conical prominence which carries palpus. The latter consists, as in Opiliones generally, of five joints, and the general structure

¹ The same muscular arrangement is met with in *Laniatores* (Sörensen, *b*, Tab. I, fig. 3).

² Palpigradi (*Koenenia* Grassi) have no mandibles.

of it in Cyphophthalmi is as follows. The joints are slender, cylindrical, a little thicker towards the apex, excepting the tarsal part (Pl. I., fig. 1 *j*, *e*) (the fifth joint of the palpus), which always approaches to the fusiform shape; the trochanterial part (*a*) is bent upwards, whilst the femoral part (*b*) is bent a little downwards; the others are nearly straight. The trochanterial part (*a*) is distinguished by a proportionately considerable length in comparison with the trochanters of the legs, and in the great majority of genera the femoral part is the longest of them all, whilst the tarsal part is distinctly shorter than the tibial part. A notable exception from this general structure of palpus is met with in *Ogovia* (Pl. II., fig. 6 *b*), where the tarsal part is longer than the tibial portion and in fact the longest of all, whilst the femoral part (*b*) is strongly compressed and proportionately short, of about the same length as the proportionately strong trochanterial part. Generally palpi are slender and without armature; *Purcellia* alone offers an exception to this rule (Pl. IV., fig. 1 *f*) through the presence of a small process on the under side of the trochanterial part. In all Cyphophthalmi hitherto known the tarsal part terminates in a small claw (Pl. I., fig. 1 *j*, *f*), which is always quite plain, without teeth, almost straight, and scarcely tapering towards the abruptly rounded apex.

It is generally recognized that the structure of palpi is of considerable systematic value within the order Opiliones. In Laniatores they are variously armed, powerful and adapted for the predatory habits of the animals, which caused Thorell to choose the name of Laniatores for this sub-order, carrying as they do an always large, generally even very large, curved and pointed claw, which can be clapped against the tarsal part and thus serves to catch the prey. In Palpatores on the contrary palpus is always much weaker, as a rule slender, and very rarely armed with fairly strong spines (*Amopaum* W. S.). The claw, which is not always present, is capable of but little movement, and as a rule only slightly longer than the diameter of the tarsal part; it is most developed in Phalangioidæ, where it is convex, a little curved and tapering very much towards the apex. In Nemastomatoidæ and Troguloidæ palpus is very slender and without a claw. The genera belonging to Ischyropsalidoidæ exhibit considerable differences in point of structure, and this is the case also as regards palpus. In *Ischyropsalis*, *Taracus*, and *Tomicomerus*, palpus is slender, and carries a very small slender claw¹, which is almost straight and scarcely diminishes in thickness towards the apex, which is abruptly rounded. In *Sabacon* and *Parasabacon crassipalpis* the palpi are, on the contrary, rather stout in proportion to their length, and the tibial part is notably thicker than the other joints, besides which these genera offer a peculiarity, in which they differ from all other Opiliones, viz. that the tarsal part when curved is raised from its horizontal position, and after describing a wide arc comes to rest in a rather deep excavation on the apical portion of the inner² side of the tibial part. The joints are clothed—the two apical ones closely—with long hairs, of which many are plumose, whilst a few particularly strong ones exhibit a peculiar, as it were articulated, appearance; a claw is altogether wanting. In those Palpatores which have a well-developed claw (Phalangioidæ), the tarsal part is noticeably longer than the tibial part, but where the claw is very weak, or none is found (Ischyropsalidoidæ, Nemastomatoidæ

¹ That C. L. Koch and all subsequent writers have denied the existence of a claw in *Ischyropsalis* is due not only to its small size, but quite as much to the circumstance that the tarsal part is rather densely covered towards the apex with hairs, which are but little shorter than the small claw. In *Taracus* the latter is even less conspicuous on account of its very light colour; it is still more difficult to see it in

Tomicomerus where it is only half as long as the surrounding hairs.

² The original specimen of Koch's *Nemastoma crassipalpe* (= *Parasabacon crassipalpis*) possessed only one palpus, which was torn off. According to L. Koch (b, pp. 111, 112) the excavation on the tibial part is found on the inner side.

and Troguloidæ) the tarsal part is as a rule distinctly¹ shorter than the tibial part. It will be seen that as regards the structure and form of palpus and the claw Cyphophthalmi approach most nearly to Palpatores and particularly to Ischyropsalidoidæ.

The locomotory limbs consist in all known Cyphophthalmi, excepting the adult male of *Purcellia illustrans*, of six joints besides coxa, viz. trochanter, femur, patella, tibia, metatarsus and tarsus.

Coxæ exhibit a constant difference in size (Pl. I., fig. 1*b*; Pl. III., fig. 2*b*; Pl. V., fig. 1*b*), the fourth pair being, as in all Opiliones, the largest, whilst the first pair is the next in size, and the second and third pair differ but little from each other. In all Laniatores the first pair is the smallest, but Palpatores vary in this respect, the first coxa being not unfrequently larger than the second and third, as for instance in *Trogulus*. But far greater is the difference between coxae observable in Cyphophthalmi, as regards their movability. In Palpatores coxae are either all immovable, as in *Ischyropsalis*, Nemastomatoidæ and Troguloidæ, or they are all movable as in Phalangioidæ², and amongst Ischyropsalidoidæ in *Taracus*, *Tomicomerus*, *Sabacón*, and *Parasabacón*, in which case, however, the fourth pair of coxae are less movable than the others, their movement being limited to a slight rotation round their longitudinal axis. In all Laniatores, on the contrary, the three posterior pairs of coxae are immovable and coalesced, the fourth pair coalescing with abdomen, whilst the foremost pair is capable of a slight rotatory movement around its longitudinal axis, whereby their maxillary lobe, which is in itself immovable, can be moved near to or away from the mandibles. *It is in fact this point of structure, or rather the difference in the arrangement of the mouth which depends on it, that constitutes one of the essential differences between the two sub-orders.*—As regards Cyphophthalmi all previous writers have stated that coxae all coalesce with one another; but this is not at all the case; the third and fourth coxae are indeed united, and the fourth coalesces with abdomen, but the first coxa is in all Cyphophthalmi capable of a little movement whereby its maxillary lobe can be brought near to or away from the mouth. So far Cyphophthalmi agree with Laniatores, but in respect of the second coxa Cyphophthalmi differ amongst themselves. In Stylocellini it is immovable and coalesced with the third coxa, but in Sironini it is movable, though only to a very small extent. This is a very remarkable fact, as it is without a parallel amongst the other Opiliones, although this order is the most polymorph amongst Arachnida, next to Acari. Apart from Opiliones, and omitting Acari with regard to which we do not venture to speak, the condition of coxae as regards mobility is uniform throughout each order of Arachnida, as may be seen from the following summary. All coxae are movable in Pedipalpi, Palpigradi, Araneæ, and—in a small degree—in Chelonethi; all coxae are immovable in Solifugæ; the first and second are movable in Scorpiones, as shown by Ray Lankester (pp. 522, 523), whilst the third and fourth are united together; and finally in Ricinulei, first, second, and third coxae are coalesced, whilst the fourth pair are movable, as we shall show below. We cannot offer any explanation of the fact of the second pair of

¹ In *Anelasmacephalus* the difference is but small; in *A. oblongus*, where it is the smallest, it amounts only to $\frac{1}{5}$ of the length of the tibial part.

² It is well known that in *Gagrella* Stol. and congeners coxae are adorned with close marginal rows of stout conspicuous processes. But this character is not peculiar to the genera mentioned. The same structure is found in *Leiobunum*, only that the processes here are very small and but slightly

conspicuous. A species from Venezuela, of which we have seen two specimens from the Museum of Göttingen, occupies an intermediate position between *Gagrella* and *Leiobunum* in this respect, as also in regard to the degree of firmness of the integuments. In *Sclerosoma* and congeners coxae are similarly adorned with processes, but these are longer, conical, and more distant from each other.

coxæ being movable in Sironini, but we can do so with respect to the other divisions. In Scorpiones the movability of the two first pairs of coxæ is explained by their being furnished with maxillary lobes; and the same consideration explains, as we have just mentioned, the movability of the first coxæ in Laniatores and Cyphophthalmi; that the fourth coxæ are movable in Ricinulei is connected with the peculiar apparatus for hitching together cephalothorax and abdomen, which will be described in a section dealing with these animals.

In all Opiliones the movement between coxa and trochanter takes place in a perpendicular plane, as also that between femur and patella and between tibia and metatarsus, whilst the movement between trochanter and femur as well as between patella and tibia takes place in a horizontal plane. In several Opiliones, amongst Laniatores as well as amongst Palpatores, a small always immovable second trochanter joint is found at the base of femur, but this is never found in Cyphophthalmi. Nor do these ever exhibit the division into spurious joints which is seen, as regards femur in *Nemastoma* and *Tomicomerus*, and as regards tibia in *Tomicomerus*, *Mastobunus* and *Astrobonus* (but not in *Sclerosoma* and "*Homalenotus*" *depressus* Can.).

In Cyphophthalmi the connection between metatarsus and tarsus admits of but very little movement, a fact which constitutes a remarkable point of difference between that suborder and Laniatores as well as Palpatores; as far as we have been able to ascertain, the movement is perpendicular in Cyphophthalmi. In Laniatores (except Oncopodoidæ) and in Troguloidæ a shorter or longer portion of metatarsus, including its distal extremity, is developed in a special manner; for instance in having a different covering of hair from that of the other part of metatarsus. In Laniatores the distal portion of metatarsus, calcaneus (Sörensen), is separated from the basal portion of metatarsus by a more or less slanting suture¹; in Troguloidæ² this is not the case, but calcaneus forms more (*Trogulus*) or less (*Dicranolasma*) of an angle with the rest of metatarsus, for which reason it has generally been mistaken by previous writers for the first joint of tarsus, a mistake which was so much the more natural as calcaneus is without those processes which are found in the other part of metatarsus in these animals. In Cyphophthalmi no calcaneus is, as a rule, developed, but in *Parasiro corsicus* E. S. (Pl. V., fig. 2*h*) the distal third of the first and second metatarsus is separated from the basal portion by a very slanting transverse groove; both the basal portion of metatarsus and tibia are densely studded with fine granulations, while the distal portion and tarsus are smooth. It may be mentioned as a peculiarity of Cyphophthalmi that metatarsus is remarkably short; in *Parasiro* it is only slightly, though unmistakably, shorter than tarsus (Pl. V., figs. 2*h* and 2*i*), but in all the other genera it equals in length only between about one half and barely a third of tarsus. In Laniatores metatarsus is always longer than tarsus; in Palpatores with long legs it is much longer than tarsus; in those with short legs of about the same length as the latter.

Tarsi consist of only one joint in all Cyphophthalmi hitherto described, excepting only the male of *Purcellia illustrans* whose fourth tarsus (Pl. IV., fig. 1*m*) is divided into two joints after the last exuviation. No great systematic importance can, however, be ascribed to this fact, because in several species of Troguloidæ one or even all tarsi are undivided³, though Palpatores

¹ Sörensen's statement (*e*, p. 53) that the calcaneus is movable in Triænonychoidæ, is not correct.

² With regard to the appearance of metatarsus in Troguloidæ we may refer to Sörensen (*a*, figs. 4*b*, 6*b*, 7).

³ According to Simon (*b*, p. 301) the second tarsi are

undivided in *Calathocratus africanus* Luc., and the same is the case in a nearly allied species in the Museum of Copenhagen, and in *Trogulus sinuosus* W. S. All tarsi are undivided in *Trogulus albicerus* W. S., which, however, is known only in individuals not fully grown.

generally have tarsi consisting of many joints; similarly *Oncopus* Thor. has undivided tarsi, though tarsi are generally divided into several joints in the sub-order Laniatores, to which Oncopodoidæ belong; albeit the number of tarsal joints is less in Laniatores than in the majority of Palpatores. But there is another point in which Cyphophthalmi strikingly differ from other Opiliones. In the other sub-orders the articulation between metatarsus and tarsus admits of more or less considerable movement. It is very considerable in Laniatores and those Palpatores whose tarsi are divided into a limited number of joints, and in these animals the tarsus can be bent somewhat upwards, so that the dorsal line of tarsus constitutes an obtuse angle with that of metatarsus. The movement is less considerable in Palpatores with many-jointed tarsi, but here the tarsus itself is capable of being curved so that its dorsal line becomes somewhat concave. These structural features are in accordance with the fact that the animals of these two sub-orders tread on the under surface of their tarsi, either on the whole under surface, viz. in Laniatores and in Palpatores with tarsi consisting of a limited number of joints, or on the under surface of the last joints of tarsus, viz. in Palpatores with tarsi composed of many joints. In Cyphophthalmi, on the contrary, the articulation between metatarsi and tarsi is, as we have pointed out, flexible only to a very small degree, and only downwards (not upwards as in *Trogulus* or Laniatores), which is connected with the fact that these animals manifestly tread only on the ends of their tarsi, at least with the three posterior pairs of legs. (This opinion was communicated to Dr. Purcell, who verified it after observation on *Purcellia*.) It is also in perfect accord with this fact that the spines, which like those on the legs of Insects serve to push off with in walking, are altogether absent in Cyphophthalmi on metatarsus as well as on tarsus. In Laniatores, excepting Oncopodoidæ, there are always a pair of spines, serving as spurs, at the distal extremity of metatarsus. Palpatores vary in this respect: many Phalangiodidæ possess a pair of such spurs at the ends of the proportionally longer tarsal joints, whilst the most distal shorter ones are without them; but not a few genera have no such spines either on metatarsi or on tarsi, such as Troguloidæ, Nemastomatoidæ, and even certain genera of Phalangiodidæ, for instance *Sclerosoma*. Even in these, however, the hairs on the under surface of tarsi are much more stiff than those which occur on the under surface of tarsi in Cyphophthalmi. We implied just now that the tarsi of the first pair of legs form an exception, though perhaps not in the whole family of Sironoidæ. It will readily be seen from Pl. III., figs. 2 *h* and 3 *d*; Pl. III., fig. 1 *f*, and Pl. II., fig. 4 *c*, that in *Pettalus*, *Ogovia*, and *Stylocellus*, particularly in *S. Pocockii* n. sp. (Pl. II., fig. 5 *d*), the distal portion of tarsus of the first pair of legs is distinguished by greater thickness than the rest along a greater or smaller part of the under surface, and that in this place there is a peculiar covering of fine perpendicular hairs standing close together and of almost equal length, which is not found either on the dorsal side or on the basal portion of the under side of this tarsus, any more than it is on any of the other tarsi. It can scarcely be doubted that the animal treads on this part of tarsus, and it must be admitted to be to some extent in accord with the fact that in Sironoidæ the first pair of legs is generally longer than, rarely as long as or slightly shorter than, the fourth, always longer than the second and third pairs, and notably than the second; because in the other sub-orders of Opiliones the first pair of legs is always the shortest, and more particularly shorter than the second, which is the longest pair in Palpatores, whilst the fourth is the longest in many Laniatores. The portion of tarsus just described is conspicuously thicker than the remainder in *Pettalus*, *Ogovia*, and *Stylocellus Pocockii*, but in the other species of *Stylocellus* this is the case only to a small extent, for instance in *S. Beccarii*.

Thor. (Pl. I., fig. 1 *p*); at the same time the difference between the hairy covering of that part of the under surface on which the animal treads and the rest of it is quite as marked as in the species mentioned before. In *Purcellia* (Pl. IV., fig. 1 *l*) the arrangement is different; the apical portion of the first tarsus is somewhat thicker than the other part, and the hair on the under surface of it closer and finer than on the rest of the under surface and on the other tarsi; but the area covered by these hairs, which here have a slanting position, is not sharply defined, as they are found some distance up the proximal part of the joint. In *Siro* and *Parasiro* (Pl. V., figs. 1 *k* and 2 *h*) no difference in the hairy covering of tarsi is observable, and we may therefore probably conclude that these animals tread on the ends of all their tarsi.

In Cyphophthalmi all the legs are furnished with one large and very movable claw. In *Ogovia* the claws on all the legs are of equal size, but in the other genera they increase in size from the first to the fourth pair, the largest increase occurring between the second and third pairs. In all Palpatores hitherto described all the legs carry one claw; in Laniatores the two first pairs of legs have one claw, whilst the two posterior pairs have two, excepting the family Triænonychoidæ, where the two posterior pairs of legs have only one claw, which however differs in shape from those on the two anterior pairs. The majority of Sironoidæ have simple claws: but in *Parasiro corsicus* (Pl. V., figs. 2 *k* and 2 *l*), and a North American species, of which Professor Thorell has kindly lent us some drawings made by the late Dr. Marx, the claws are all serrated on the under side. Amongst Palpatores no instance of serrate claws on the legs has hitherto been described¹, but amongst Laniatores in many genera the two posterior pairs of legs frequently have pectinate claws; the two anterior pairs never carry such.

5. *The Mouth and Stomotheca.*

It is well known that in Cyphophthalmi the mouth is placed in a cup-shaped depression to which Thorell gave the name of stomotheca (*c*, p. 23), which we adopt. The stomotheca is formed (Pl. I., fig. 1 *l*) by the first pair of coxae, but is closed behind by the maxillary lobes of the coxae of the second pair of legs. The inner surface of the first pair of coxae forms always the side walls, and in some genera, viz. *Pettalus*, *Purcellia*, *Siro* and *Parasiro*, these surfaces also partly close it above. It is not, however, the entire inner (or anterior) surface of the first pair of coxae that enters into the composition of stomotheca, but only the proximal portion, which as a rule is the longer one, whilst the distal portion (between *e* and *f* in fig. 1 *l*) slants inwards and forwards, forming a more or less sharp corner (*f*) with the proximal part. The under surface of the coxa makes an angle with the proximal portion of the inner surface, which forms the wall of stomotheca, but rounds off more gradually into the distal portion of the same, which is situated in front of stomotheca. On the under surface of the first coxa a ridge² runs along the border of stomotheca, our

¹ We express ourselves thus cautiously, because the matter does not appear to us to have received much attention. It is well known that the claws of palpi are serrate in several Phalangioïdæ, such as *Sclerosoma* and allied genera, *Leiobunum*, several species of *Gyas*, and, according to Thorell, in the majority of his group *Gagrellini*.

² It is no doubt to this ridge, not to the real maxillary lobe, that Simon refers when he says (*b*, p. 142), "Lobe maxillaire de la première paire réduit à un simple rebord soudé, immobile," because in speaking of the first pair of coxae he says (*a*, 241) that they are "carénées du côté interne et doivent jouer la rôle de mâchoires."

carina stomothece (*g*), which is marked off by a groove, and of which the anterior extremity often forms a projecting point. Thorell has already (*c*, p. 24, note 2) drawn attention to the fact that the shape of stomotheca is different in different genera; but even within the genus *Stylocellus*, the only one of which a larger number of species are known, small differences in this respect are noticeable between the species. In Laniatores stomotheca is not very well defined; in Palpatores a stomotheca is hardly formed, except in Troguloidæ where it is very well developed.

As the structure of the mouth in Cyphophthalmi has not been well described by previous writers, we consider it desirable to begin by giving an account of this structure in the other sub-orders of Opiliones. In this order generally the mouth is composed of 1° a clypeus and a labrum, 2° the mandibles (maxillæ auctorum), which meet in the middle line beyond the distal extremity of labrum, and 3° the maxillary lobes of the first pair of coxae which enfold the posterior part of the mandibles laterally and from behind. In Laniatores and Palpatores these parts are supplemented by a prolongation of sternum, labium sternale, which enters between the maxillary lobes of the first pair of coxae. In the great majority of Opiliones the coxae of the second pair are furnished with maxillary lobes, but these are always placed outside and behind the mouth proper. A characteristic feature is that all the parts which surround the oral cavity, viz. labrum, mandibles, maxillary lobes of the first pair and labium, where it exists, terminate in soft thin-skinned and therefore white portions, which turn inwards towards the cavity of the mouth, but besides are sometimes continued outside the border of the oral cavity, in the shape of soft cushions. On the maxillary lobes of the second pair of coxae no such soft part is ever found. When the mouth opens the mandibles are moved a little forwards and away from each other, whilst the maxillary lobes of the first pair of coxae are moved a little outwards and backwards, whereby the orifice of the mouth is placed partly between the mandibles and the maxillary lobes of the first pair of coxae, partly also between the mandibles themselves.

The mandibles are essentially alike in all Opiliones, their pars manducatoria being placed outside clypeus and labrum and bent downwards and backwards.

The maxillary lobes of the first pair of coxae on the contrary offer considerable differences in different divisions of the order. In Palpatores they consist of three portions: a soft distal one and two more or less chitinized parts, a basal and a more distal one. Simon (*b*, p. 124) has already pointed out this fact as regards Phalangioidæ. Of the two chitinized portions the distal one is movable in all Palpatores. In Phalangioidæ (woodcuts figs. A and B) the basal portion is besides movably connected with coxa. In several genera of this family the basal portion carries anteriorly and distally a projection in the shape of a horn (woodcut fig. B) which is not found in other genera¹. In Phalangioidæ the two more firmly chitinized portions of the maxillary lobe are almost of the same length, measured from the base to the distal margin; but in *Ischyropsalis*, Nemastomatoidæ, and Troguloidæ (woodcut fig. I), the

¹ The horn is found in *Acantholophus*, where it is small, in *Phalangium* and *Mitopus*, but not in *Sclerosoma*, *Gagrella* and *Leiobunum*.—Simon (*b*, p. 158) enumerates amongst other characters of his sub-family Sclerosomatinae, that the mandible ("lobe maxillaire de la patte mâchoire") is furnished with only one horn ("tubercle"), whilst Phalangiinæ, according to him, have two such. But, though some of the latter really

have two horns, for instance *Ph. opilio* L. (see woodcut A), this is far from being the case with all. *Ph. parietinum* de Geer, for instance, has only one. What Simon in this and similar cases has mistaken for a second horn on the mandible is the horn mentioned above as occurring frequently on the maxillary lobe of the first pair of coxae.

basal portion is much shorter than the more distal one and immovably connected with coxa itself, forming merely a ridge alongside the anterior (or interior) side of the proximal part of coxa; it is consequently not readily distinguished, particularly as it is situated at a higher level, and therefore it has not hitherto been recognized. At the same time the distal one of the two chitinized portions is differently shaped in the two groups; in Phalangioidæ its two dimensions, measured respectively from the base to the distal margin, and from the posterior to the anterior margin, are not greatly different; but in *Ischyropsalis*, Nemastomatoidæ and Troguloidæ, the latter of these two dimensions is much longer than the former, in accordance with which the mouth is of a somewhat elongated form. In this respect Troguloidæ show the greatest divergence from Phalangioidæ, while *Ischyropsalis* exhibits the smallest difference from that family; but it is a remarkable circumstance that whilst *Ischyropsalis* agrees with Nemastomatoidæ and Troguloidæ as regards the immovability of the proximal portion of the maxillary lobe, the other genera of Ischyropsalidoidæ, viz. *Taracus*, *Tomicomerus*, *Sabacon*, and *Parasabacon*, agree with Phalangioidæ in this respect, the basal portion of the maxillary lobe being movably connected with coxa, as in that family. It will be seen that the differences between the several genera of Palpatores in respect of the movability or immovability of the proximal portion of the maxillary lobe of the first pair of coxae do not coincide entirely with the limits of the families. But there exists a correlation between the movability or the contrary of the proximal portion of the maxillary lobe in question, and the movability of coxae; they are either both movable or both immovable, and the reason is no doubt mechanical. The fact is that, whilst in Laniatores and Cyphophthalmi the first pair of coxae are capable only of a minimum of movement, their movability—and the movability of the three other pairs—in Phalangioidæ and the genera of Ischyropsalidoidæ above enumerated is manifestly sufficiently considerable to be of some, though scarcely much, importance for the use of the legs in locomotion. It is clear that if, under these circumstances, the connection between the maxillary lobe and the first pair of coxae admits of some movement, the latter can be moved without interfering with the movements of the maxillary lobes, that is of the parts of the mouth.

In Palpatores *labium sternale* (woodcuts figs. B and I, *i*) projects between the maxillary lobes of the first pair of coxae, and is joined to the latter to a greater or smaller extent, in Phalangioidæ through almost half its length, in Troguloidæ through the whole of it. Labium sternale exhibits a good deal of difference in respect of shape and of its relation to the rest of sternum; as, however, we have treated of this matter in connection with sternum, we may here refer the reader to our remarks on the latter.

Behind labium, that is to say, really outside the mouth, we find *the maxillary lobes of the second pair of coxae*. In the Palpatores they are of rather elongated shape. They do not terminate in soft cushions as the other parts of the mouth do. In Phalangioidæ they (woodcuts figs. A and B, *lcx²*) are very movable and execute quick, oscillating movements, which are easily seen when the captive animal uses the mouth; when at rest they occupy a slanting position underneath the maxillary lobes of the first pair and labium, pressed against these parts of the mouth. In Ischyropsalidoidæ the maxillary lobes of the second pair of coxae have a downward direction and are much less developed than in Phalangioidæ. In *Ischyropsalis* their shape is more oblong conical, and they are undoubtedly capable of movement; in *Taracus* they resemble a low rounded cone and are perhaps movable; in *Tomicomerus* they are shaped like low rounded tubercles or thick cones, and are scarcely capable of movement;

in *Sabacon* and *Parasabacon* finally they are entirely absent. Sörensen, the first author who made a really careful study of the structure of the mouth in different Opiliones, denied (*a*, p. 509) the existence of maxillary lobes of the second pair of coxae in Nemastomatoidæ and Troguloidæ. As they are found in all other groups of Opiliones, though in some cases being only rudimentary, with the sole exception just mentioned, we have attentively investigated the question as regards these two families, with the result that we have found no vestiges of them in Nemastomatoidæ, but in those Troguloidæ which we have examined, viz. *Trogulus* and *Anelasmococephalus*, they exist in the shape of a pair of very small flat prolongations of the proximal extremities of the coxae (woodcut fig. F, *lcx^o*), quite incapable of movement.

The mouth of Laniatores offers the following essential differences from that of Palpatores. The maxillary lobes of the first pair of coxae consist of only two parts, a distal one with soft skin, and a proximal one, which is firmly chitinized, immovably joined to coxa, and capable of being moved only with the latter, of which the movement is rather limited. In many Laniatores the maxillary lobe makes a sharp angle with coxa, and may therefore be described as clearly marked off from it, but there are several others, for instance Cosmetoidæ, in which the maxillary lobe projects from coxa forming an even concavity, whereby the boundary between the lobe and coxa is rendered less distinct. Labium sternale is joined to the maxillary lobes of the first pair of coxae only at the very base; it is always weakly chitinized, contrary to what is the case with the other parts of the mouth, excepting the distal portion of the maxillary lobes of the first pair of coxae. The maxillary lobes of the second pair of coxae are never capable of movement; in most of the families, for instance in Gonyleptoidæ and Cosmetoidæ, they are not much developed and appear as low, rounded tubercles on the anterior and interior corner of either coxa; but in several families, as in Triænonychoidæ and Biantoidæ, they are elongate and directed forwards and downwards; wherever they project independently they are sharply marked off from coxae¹.

The mouth of Cyphophthalmi has hitherto been but little studied, and the mandibles² are the only parts of it with regard to which authors may be said to agree. These (Pl. I, fig. 1*l*; Pl. III., fig. 2*f*) have rather a downward direction, and their soft terminal portion is covered with short pointed hairs which stand closer together on the interior surface than on the others. In *Purcellia* the hairy covering is less dense, and the single hairs are at the same time more rigid, almost spiniform (Pl. IV., fig. 1*g*). Such hairs also occur on the soft portions of the other parts of the mouth; their points are mostly turned backwards.

Labrum (Pl. I., fig. 1*h* and 1*i*; Pl. III., fig. 2*f*) consists of two parts, a proximal part, clypeus, and a distal part, labrum proper. Clypeus (Pl. I., figs. 1*h* and 1*i*, *cl*) is very short, but broad, with a posterior prolongation (*p*) on either side in the shape of a wing, to the inner surface of which some of the musculi dilatatores of oesophagus are fixed. Frequently a small chitinized piece extends from clypeus upwards between the bases of antennæ. Labrum proper (Pl. I., figs. 1*h* and 1*i*, *l*) is rather broad just at the base, but the larger, anterior, distal portion, which extends forward between the anterior portion of the mandibles, is so much compressed from the sides that as a rule it is difficult or even impossible to see it on

¹ Sörensen has stated that in these cases the maxillary lobes of the second pair of coxae are movable; but Thorell and Loman are right in maintaining that this is not so.

² There can be no doubt that the organs mentioned by

Joseph (*a*) under the name of maxillary pyramids, are the mandibles, though we do not quite understand his description; nor have we been able to understand his description of the other parts of the mouth.

account of its narrowness, except by dissection¹. For this reason the existence of a labrum in these animals has been denied by Thorell (*c*, p. 29; *f*, p. 765).

The firmly chitinized part of the maxillary lobes of the first pair of coxae can hardly be described as separated from coxa; in *Stylocellus* it appears in the shape of a narrow very low ridge (Pl. I., fig. 1 *k*) on coxa proper. The soft, terminal portion of the maxillary lobe is divided into portions by narrow but deep incisions. Of such portions there are two in Sironini (several figures on Pl. IV. and V.), three in *Stylocellus* (several figures on Pl. I. and II.); it is only in *Ogovia* (Pl. III., fig. 1 *d*) that we have been unable to ascertain their existence; but in the only specimen of this animal which we have had an opportunity of examining, the rather large anterior soft part of the maxillary lobe had collapsed. The foremost of these divisions is always narrow and stretches forward along the outside of the distal portion of the mandibles in such wise that the maxillary lobes of the first pair of coxae embrace the mandibles posteriorly and on the sides. So far the arrangement is the same in Cyphophthalmi as in the other sub-orders, but in the former the lobes envelop a greater length of the terminal portion of the mandibles than in the latter, though not to the same extent in all Cyphophthalmi. In *Ogovia* (Pl. III., fig. 1 *d*) the soft part of the maxillary lobes scarcely reaches the middle of the outer side of the mandibles, when these are seen straight from beneath; but in the other genera it reaches somewhat beyond the middle, or even nearly to the anterior extremity. The middle and the posterior divisions of the soft part of the maxillary lobes or the posterior division, if there are but two, on either side meet the corresponding division on the other side in the middle line behind the mandibles; they are always broader and shorter than the anterior division; in *Siro* and *Parasiro* the hindmost division is plainly distinguishable (several figures on Pl. IV. and V.), whilst the foremost appears as a very narrow strip, which is discovered only with some difficulty. Where three divisions are found the hindmost is the smallest of them. *Siro* and *Parasiro* differ from the other genera in this particular, that the soft part of the maxillary lobe of the first coxa does not reach back quite so far as the proximal extremity of the latter, as it does, on the contrary, in the other genera, where consequently the soft part of the mouth reaches back to the maxillary lobes of the second pair of coxae.

A labium sternale does not exist in Cyphophthalmi. What Sörensen (*d*, p. 559) has considered as such in *Siro duricorius* is the hindmost pair of the soft division of the first pair of maxillary lobes in connection with the part of coxae which is situated just behind.

The maxillary lobes of the second pair of coxae have hitherto been recognized only by Thorell². Sörensen denied their existence in *Siro* (*d*, p. 559), but they occur in all the genera, though with certain differences. In Stylocellini (Pl. I., fig. 1 *l*, *lcx*², and several other figures in Pl. I. and II.) their principal direction follows the longitudinal axis of the animal, and they form a very obtuse angle with carinæ stomothecæ; but in Sironini (Pl. III., IV. and V., several figures) their main direction lies rather across the longitudinal axis of the animal, and

¹ We have accordingly been unable to make it visible in our illustrations of the mouth in the different genera, except in *Pettalus*. Moreover the spot in question is often obscured by a deep shadow.

² In treating of *Siro corsicus* Thorell mentions them (*c*, p. 24, note 2) in these words: "coxae 2^{di} paris tum suturam obsoletam versus basin ostendunt, quae suturæ laminas duas (partes coxarum basales) limitant: has laminas lobos maxillarum pedum 2^{di} paris loc. cit. (num recte?)

creddidi." Their existence in *Stylocellus* is indicated in the following words (*ibid.* p. 27), "quae duae costae [carinae stomothecæ nobis] postice callis duobus parvis, e margine basali coxarum 2^{di} paris formatis, anteriora versus divariantibus, V parvum fere formantibus et paene ad aperturam genitalem pertinentibus continuantur, cum iis stomothecam limitantes."—A long time after we had written this section the lobes in question were seen in *Stylocellus* by Börner.

they form therefore almost right angles with carinæ stomothecæ. As this difference in their position coincides with the fact that the second pair of coxae are immovable in Stylocellini, but capable of movement in Sironini, there can be little doubt that the movability or the contrary of the second pair of coxae is of importance, in some way or other, for the action of the mouth, but we are unable to suggest in what the importance may consist. The maxillary lobes of the second pair of coxae are never movable in Cyphophthalmi, nor are they furnished with a soft terminal part; but they are clearly, though not sharply, marked off from the rest of coxa.

It will be seen that as regards the structure of the mouth Cyphophthalmi differ in several points from the other sub-orders, principally by the absence of a labium sternale. It should be emphasized that, in respect of the structure of the mouth, they differ more from Palpatores than from Laniatores, although the mere outer form of their stomotheca recalls the Troguloidæ more than the other Opiliones.

6. *The Organs of Sense.*

A. *The Eyes.* The only real eyes found in Cyphophthalmi are those which previous writers have described as "sessile eyes." Amongst the six genera with which we are acquainted the only one which possesses eyes is *Stylocellus*; the others are all blind, and this must also be the case with "*Siro*" *cypropselaphus* Jos. (which undoubtedly must be transferred to another genus), and with *Miopsis* Thor., with which we are equally unacquainted, and in which Thorell says that "sessile eyes" are not found.

All species of the genus *Stylocellus* possess one pair of eyes, which must be considered small. They are always placed widely apart, a short distance from the lateral margin of cephalothorax (σ in Pl. I., fig. 1 d), and they are not placed on any protuberance, in which respect they differ from those of the great majority of Opiliones. They are, so to say, placed as far backwards as possible, as their position is above the coxae of the second pair of legs, and in Arachnida the boundary between head and thorax lies precisely behind the second pair of legs. They are but slightly convex, either circular or a little elliptical. As we are dealing with a group of animals in which the majority of genera contain blind animals, we wish to affirm expressly that these eyes are real eyes, with a lens, not like those of *Schizomus Simonis* nob. belonging to Tartarides, or of the genus *Chernes* belonging to Chelonethi (Pseudoscorpiones), mere eye-spots, that is to say, eyes in which the surface of the so-called lens is not perfectly smooth, and which therefore can scarcely be supposed to be of use to the animals possessing them for the purpose of real vision.

In our estimation there can be no doubt that the two eyes which occur in *Stylocellus* correspond morphologically to the pair of eyes met with in other Opiliones. This view is not only supported by their number, but also by the circumstance that amongst Laniatores the eyes are placed widely apart in Biantoidæ and in the sub-family Stygnini proposed by Simon, although even in these groups they are not placed so laterally as in *Stylocellus*.

In this connection we may mention those Opiliones other than Cyphophthalmi to which more than one pair of eyes have been ascribed. According to Doleschall a species from India belonging to Palpatores possesses three pairs of eyes, for which reason Thorell in 1876 (b, p. 114) established the genus *Hexomma* for this species, on the authority of Doleschall; but in 1891

Thorell states (*f*, p. 678, Note 2), "Fateor tamen, satis dubium mihi videri, Opilionem oculis sex praeditum (Phalangium (Hexomma) vulcanicum Dol.) in rerum natura existere!" Amongst Laniatores *Octophthalmus marginatus* has, according to Wood (pp. 439, 440), four pairs of eyes, but this animal has never since been mentioned by any writer. Finally, two pairs of eyes were ascribed to *Phalangodus (Feretrius) quadrioculatus*, by L. Koch (*a*, p. 880); but Sörensen (*e*, p. 75) has ascertained by examination of Koch's original specimen that one pair of these "eyes" are merely grains on the ocular protuberance.

B. *The Organs of Sensation of the Skin*¹. We have found various organs in Opiliones which undoubtedly serve purposes of sensation, and which may be referred to two classes, viz. peculiarly developed hairs and the so-called lyriform organs.

We have searched with great attention for peculiarly developed hairs in Cyphophthalmi, and we have found them in three places. On examining the skin of an adult *Purcellia*, which had been cleaned by means of caustic potash, we noticed peculiarly developed hairs in two places on the surface of cephalothorax. Exactly on the spot on either side where the eye is placed in *Stylocellus*, a little inside the lateral margin of cephalothorax and a little in front of the tubercle in which the odoriferous gland opens, a solitary seta was found, many times longer and thicker than the very fine and short hairs which occur scattered over the surface of cephalothorax. Another peculiarity of this seta is that it is placed on a small hollow knot. In young individuals the same bristle (Pl. III., fig. 3 *g*, *s*¹) is found placed in the same manner. In the adult *Pettalus brevicauda* Pock.² this bristle is very conspicuous, even when looked for by means of a pocket lens. The area round its point of insertion is considerably raised and shows a different sculpture from that of the surrounding parts; it is found also in the young of the same species, but the place of its insertion is less marked. We have looked in vain for this bristle in the other blind species of this group; but we do not feel justified in saying on that account, that it is absent altogether, because we have seen only one specimen of *Ogovia*, and we have not examined specimens either of *Siro* or of *Parasiro* especially prepared for this search. Both in *Ogovia* and in the other genera it must be supposed to be placed, if it does exist, near or on the cone in which the odoriferous gland opens, but if the bristle is either broken on the specimen examined or not distinguished by special size, it would be difficult to find it without previous preparation for that purpose, or to distinguish it amongst the other scattered bristles. We even consider it very probable that this bristle does occur in the other genera, because Joseph (*c*, p. 20) says of *Siro cyphopselaphus* Jos.—a species which we do not know: "Eyeless, but furnished with two long tactile hairs instead of eyes, which are placed on the lateral conical protuberances³." We consider it extremely probable that the long hairs which Joseph describes as placed on the lateral conical protuberances, on which the stink glands open, correspond exactly to the bristles which we found in *Purcellia* and *Pettalus* between the lateral margin of cephalothorax on either side and the cone with the opening of the gland, which here occupies a more dorsal position.

We may remind our readers that Grassi and we ourselves have examined a very remarkable hair, evidently sensory, in the blind *Koenenia mirabilis* placed in the very

¹ The investigation of these organs has been performed by H. J. Hansen alone.

the bristle in *Purcellia*.

² We did not search for it in *P. cimiciformis* Cambr. because we had returned the specimen before we discovered

³ According to Joseph (*ibid.*, p. 21) they received their nerves from the suboesophageal ganglion.

position¹ which the lateral eyes occupy in Pedipalpi. According to Michael a pair of remarkable hairs are found in Oribatidæ, to which he gives the name of "pseudo-stigmatic organs." Michael gives (*a*, pp. 186—190) a careful general description of these hairs, which are very different in different forms, and in some cases remarkably built, in addition to which he mentions and figures them in treating of the different species. Michael considers them to be probably organs of sense, and we are of opinion that they may naturally be compared to those hairs serving purposes of sensation, which occur in *Koenenia* and in Sironini: and they occupy a somewhat similar, though more dorsal, position on cephalothorax. In the other two sub-orders of Opiliones nearly all the species possess well developed eyes, nor have we found any such hairs as those we have described in any of the species which we have examined. In each of the two sub-orders a few blind species are known, but we are not acquainted with them.

In all the Cyphophthalmi which we have dissected, *Stylocellus*, *Purcellia*, *Siro*, and *Parasiro*, we have found a pair of frontal bristles destined for sensation, and as we have been able to ascertain their presence in *Pettalus brevicauda*, without dissection, we believe that they are found throughout that sub-order. The most characteristic form of these sense hairs we found in *Purcellia* (Pl. IV., fig. 1 *a, s*), where they are placed a little behind the anterior margin of cephalothorax, near the posterior extremity of the median excavation, at a small distance from each other; they are shorter but conspicuously thicker than the small bristles near them, from which they may be distinguished also by their shape, as they are almost cylindrical, abruptly pointed at the apex. In a specimen not fully grown we found them well developed, only more gradually pointed. In *Stylocellus Beccarii* (Pl. I., fig. 1 *c, s*) these sense hairs stand somewhat farther from the anterior edge of cephalothorax; they are shorter, proportionately thicker, and fairly evenly conical. In *Siro duricorius* these hairs are placed close together, at the anterior edge itself, and as they taper more gradually towards the apex, they are more like ordinary bristles, but are nevertheless easily distinguished from them. Also with regard to this pair of sense hairs, we may recall that Grassi and we ourselves have examined a hair of that kind in the blind *Koenenia mirabilis*, which is of very peculiar shape, as it were bifurcate, and placed on the front in the middle line above the bases of antennæ. We have searched for a similar pair of hairs developed for sensation in a few representatives of the two other sub-orders of Opiliones, but in vain; and although it would not in itself be unreasonable to expect their presence, we believe that we may with tolerable certainty affirm that no such hairs are found in other Opiliones.

Finally, we found sensory hairs on the dorsal side of tarsus of the two anterior pairs of legs, but only on these pairs. The hairs are met with in all species similarly built in both sexes, and also in young specimens of *Purcellia*. Generally about half a score or a few more of them are found, scattered near the middle line on the distal half of each tarsus, in some cases on a considerably larger portion; but in the remaining shorter or longer portion of tarsus, near its proximal extremity, they are never found. In *Ogovia* and *Pettalus* their number is reduced to from four to seven on each tarsus. These hairs are always easily recognized amongst the ordinary hairs or bristles, being light of colour, short or of medium length, rather stout and of a peculiar shape. They are always more or less curved and with the end obtuse, whilst the surrounding hairs or bristles terminate in a long and

¹ In a subsequent paper one of us (H. J. Hansen, *c*, p. 205) has shown that in other species of *Koenenia* a bundle of two, three or four such hairs is found where the single hair mentioned is placed in *K. mirabilis*.

extremely fine point. The insertion of these sensory hairs is also rather different from that of the surrounding bristles. Round their point of insertion the skin is thinner, so that this point is in a lower level, but they cannot well be described as inserted in the bottom of small calicles, as is the case with another kind of hairs developed for sensation, which are found in several other orders of Arachnida. In *Pettalus*, *Purcellia*, *Siro* and *Parasiro* they (Pl. V., fig. 2 h, s) protrude considerably, and as they are at the same time of medium length in the species of these genera, except in *Pettalus brevicauda*, they are very conspicuous, when tarsus is viewed from the side. In *Ogovia* and *Stylocellus* (various figures on Pl. I., II., III.) they are comparatively short and at the same time more closely pressed against the surface or more curved, so that they are very often not easily seen; even a slight turning of tarsus suffices to hide them entirely. We are of opinion that these hairs must be organs of feeling of some description.

In (the male) *Acantholophus ephippiatus* C. L. Koch, which belongs to Phalangoidæ, one or two hairs developed for sensation are found on each of the last eight tarsal joints of the first pair of legs, and of the last eleven tarsal joints of the second pair of legs, corresponding in shape, colour, and mode of insertion to those which occur in *Purcellia* and others. On the upper surface of the distal half of the last tarsal joint of the same two pairs of legs, as well as on the upper portion of the terminal surface of this joint, several short, conical, near the base thick, slightly curved or almost straight sensitive hairs occur, and on one or two of the penultimate tarsal joints there is a similar hair. The last two pairs of legs are equipped with both kinds of sensitive hair; we have not found any of the longer kind on the last joint, but on each of the preceding three joints we have found one; the number of the short conical hairs is less than on the first two pairs of legs. As regards the last-named kind of sensory hairs we refer, for the rest, to the description given below of those in *Assamia Sörensenii*.—In *Nemastoma lugubre* O. Fr. Müller the first pair of legs carry on the upper surface of the last tarsal joint several sensory hairs, which are quite like those in *Purcellia*; some are found on the first tarsal joint, and one solitary similar one on nearly all the other joints. Tarsus of the second pair of legs is similarly equipped, but on several of the joints the number of these hairs is somewhat larger. On the last tarsal joint of the last two pairs of legs there are one or two sensory hairs, whilst a solitary one is found on one or two of the more distal joints. Besides these, at least one of the short thick conical sensory hairs, which here are almost abruptly bent in the middle, occurs on the distal portion of the terminal tarsal joint of all the legs. Finally, a large number of somewhat different hairs are noticeable on the proximal part of metatarsus of all the legs, whilst a minor number of the same occur on the distal portion of the second metatarsus. These hairs are rather light in colour, much curved and protruding; they are at the same time finer than the tarsal sensory hairs, particularly in their distal portion. In general appearance these hairs are to some extent intermediate between the tarsal sensory hairs and ordinary hairs; we do not venture to decide whether they serve purposes of sensation, but it is not improbable. We have furthermore satisfied ourselves of the presence of both kinds of sensory hairs on tarsi of the second and fourth pairs of legs in a species of *Dicranolasma* belonging to Troguloidæ; but we have been obliged to forego a systematic search for them, because we have not had an opportunity of dissecting a specimen, which would be necessary on account of the shortness of the first and third pairs of legs. However, we have been able to point out the presence of such hairs in representatives of three out of the four families comprised in the sub-order Palpatores, and, what is particularly important, the two species, which we have been able to examine carefully, are good represen-

tatives of the two tribes into which we divide the sub-order, and they agree with each other in the essential features.

Amongst Laniatores we have specially examined *Assamia Sörensenii* Thor., and found one or two sensory hairs on the upper surface of the terminal tarsal joint of the two first pairs of legs; they are long, light-coloured, blunt, and very like those found in *Purcellia* as to shape and mode of insertion; sometimes one similar hair is also found on one of the preceding joints. Besides these hairs three peculiar bristles are placed in a longitudinal row on the upper surface of the last tarsal joint just above the place where it slants downwards to the claw; the proximal one of these bristles is slightly curved or almost straight, conical, short, and rather thick at the base; the middle bristle is of similar shape, but a good deal stouter and longer; the last one is of the same thickness as the middle one, but long. Finally, a few bristles are found arranged in a transverse row on the upper portion of the terminal face of metatarsus just above the insertion of tarsus; on the second metatarsus we have counted four of them; they resemble most the middle one of the three bristles on the distal extremity of the last tarsal joint. These two sets of bristles are inserted in the same manner; they are not placed in calicles, but a broad belt of soft skin surrounds the base of each of them. We entertain no doubt of these bristles being a kind of sensory hairs; in appearance they differ considerably from those on the upper surface of tarsus, but it does not follow that they have an entirely different function. On the upper surface of the last tarsal joint of the last two pairs of legs we have found a very short and stout conical sensory bristle, close in front of the extreme edge of the joint, and a similar but a little longer one on the upper free portion of the terminal face of metatarsus of the same pairs. We have besides examined *Cosmetus (Gryne) oreensis* W. S., which we selected for examination, because within the limits of Laniatores it stands far from *Assamia*. On tarsus and metatarsus of the first two pairs of legs we found the same two kinds of sensory hairs in the same or nearly the same number as in *Assamia*. On the upper free part of the terminal face of the third and fourth metatarsus we found a solitary one of the short sensory hairs, but we have been unable to find any such on the last tarsal joint. In the families of Cosmetoidæ and Gonyleptoidæ, but not in Assamoidæ, the last tarsal joint of the third and fourth pair of legs carries on the upper surface near the end a downwards bent process ("pr. terminalis") which, at least as a rule, has a couple of long, slightly curved sensory hairs (v. Sörensen, b, Pl. I., figs. 10, 11), and in these two families we have been unable to find the short conical sensory hair present in *Assamia* just in front of the end of the tarsus.

A general survey of the distribution of sensory hairs on tarsus and metatarsus in Opiliones brings out the following characters. Throughout the order the elongated, blunt, light-coloured, somewhat curved sensory hairs occur at least on a part of tarsus of the first two pairs of legs. In the sub-order Cyphophthalmi no other sensory hairs are found on those divisions of the legs. In Laniatores this kind of sensory hairs is only found on the terminal joint of tarsus, and besides these the more or less conical hairs are found at the distal extremity of the terminal tarsal joint of the first two pairs of legs, at the distal extremity of all metatarsi, as well as at the distal extremity of tarsi of the last two pairs of legs, with the exception that in some families the last-named conical hairs on the posterior tarsi are replaced by hairs on their "processus terminalis." In Palpatores the elongated sensory hairs are found on the distal joints of all tarsi, but many more on the first two pairs of legs than on the last two pairs; finally, one or more of the conical sensory hairs are found at least at the distal extremity

of tarsus. We believe that these characters hold good for the whole order and the three sub-orders respectively; but as we have as yet examined but a limited number of representatives, we have refrained from inserting our results as characters in the systematic table which we propose to give below, and content ourselves with drawing attention to them here.

Hansen has described (*b*, pp. 197, 198) some hairs of extremely complicated structure found in varying number on palpi in *Nemastoma*¹, and also some not less remarkable pencils of microscopic hairs found on metatarsus and some of the proximal joints of tarsus of the first three pairs of legs in the male *Phalangium parietinum* de Geer.

*Lyriform Organs*². Gaubert was the first who, in 1892, pointed out the occurrence in Opiliones of the remarkable organs of sense, formed like buttonholes, which he called lyriform organs, because in Araneæ, where they are found in great numbers, they are very often placed together in regular groups, distantly recalling the figure of a lyre. Gaubert examined particularly *Phalangium opilio* L. and found such lines or fissures on the basal joint of antennæ as well as on coxa and femur of the legs. In *Trogulus* he found them on the same parts of the legs; but he did not describe them here more particularly. In 1893 Hansen (*b*, pp. 192—196) studied the distribution of the organs both in *Phalangium opilio* L. and particularly in *Nemastoma lugubre*. In this latter species they occur, according to his account, on cephalothorax, on all abdominal segments, both on the tergites and sternites, except on the median ventral piece of corona analis; furthermore on the first and second joints of antennæ, on the mandibles, on the trochanterial as well as the femoral and tarsal parts of their palpi; finally on coxa, trochanter, femur and the last tarsal joint of the locomotory legs. It is only on the limbs that several lines are to be found near to each other, and they are found collected into real groups only on trochanter of the legs and on palpi; but even in these there is no really regular grouping of them, such as is seen on the walking legs of Araneæ. In *Phalangium opilio* the number of lines is somewhat smaller, but they occur nevertheless in most of the places where they are found in *Nemastoma*, and the principal difference seems to be that they are wanting on tarsi of legs and palpi. To this, however, we must now add that a solitary transverse line is to be seen on the upper surface and a similar one on the under surface, of the penultimate joint of the two branches of ovipositor in *Phalangium opilio*, *Leiobunum rotundum*, *Gagrella minax* and *Sclerosoma monoceros*, and therefore probably in all Phalangioidæ. On one specimen of *Phalangium opilio* we found, instead of four solitary lines or fissures, four groups of such, containing each from two to four fissures. In the other families of Palpatores we have not found any lines on ovipositor: as, however, those which we have examined had not been previously cleaned with caustic potash, we do not feel able positively to deny the presence of lines on them.

¹ According to Simon (*b*, pp. 292, 306) similar hairs are found on palpi in *Amopaum Sörensenii* Thor. and *Trogulus aquaticus* E. S.

² The function of these organs of sensation is not known. An inspection, for instance, of the abdominal tergites in a *Thelyphonous* reveals on each of them a small number of lines, which when examined by transmitted light appear like sharply cut fissures which almost entirely penetrate the skin. In each of these fissures a very small dilatation is found of a peculiar shape and nerves are seen terminating at this point. In certain places on the walking legs of *Thelyphonous* several

such fissures of different length are arranged rather close together, forming an irregular group; on the limbs of Araneæ such groups are found, in which the lines stand in regular order side by side, and which at the same time exhibit a peculiar appearance on account of the lines diminishing in length from one side of the group to the other, sometimes also by a gradually increasing curvature and by the distribution of the places where the nerves terminate. It is with reference to these groups that Gaubert proposed the appellation "lyriform organs," which has since been extended so as to apply also to single isolated lines.

Amougst Laniatores we have examined *Phalangodes Piocardi* Sim., but we are not in a position to give more than a summary account of the occurrence in that species of these organs. We are unable to point out any line on the surface of cephalothorax with perfect certainty, because it was not possible to decide whether certain formations, extremely few in number, near its lateral margins, which looked like fissures, were lyriform organs or not. But lines were found on nearly all the abdominal tergites and sternites, from two to five on each, and they occur probably on them all. On the large plate formed by the fusion of the second and third sternites the organs are grouped as in *Phalangium* and *Nemastoma*, and in all three types in such a manner that their distribution agrees with the view that the plate is composed of two sternites. Antennæ have a line on the outside of the basal joint. On palpi a line is found on the inside of the trochanterial part; there is another small one on the inside of the femoral part; two very long ones are found on the dorsal side and a small one on the middle of the inside; the tarsal part has a long line on the outside. The walking legs have one or two lines on the proximal part of coxa, one on trochanter, at least one very long transverse line on the dorsal side of femur near its distal extremity, and one or two long transverse lines across the dorsal side of metatarsus near the end, but we could not decide with certainty whether this joint also possesses some small longitudinal line, such as Hansen (*b*, p. 196) found in *Pachyloides uncinatus* W. S.

It will be seen that the distribution of the lyriform organs in the small representative of Laniatores which we have examined agrees to a considerable extent with our account of the arrangement in Palpatores. We consider it probable that in types of different families of Laniatores lines will be found in parts of the limbs where we have not discovered any such in *Phalangodes*, as is the case in *Pachyloides* just mentioned; but it is extremely improbable that an essentially different distribution or grouping will be met with. We are, however, compelled to content ourselves with these remarks, because the search for these organs in Laniatores is extremely difficult on account of the peculiar nature of the skin, which renders the complete sacrifice of the specimens necessary.

Amongst Cyphophthalmi we have searched for lyriform organs only in a male *Purcellia illustrans*, which species in a measure occupies an intermediate place between the two most widely separated genera, *Stylocellus* and *Parasiro*, and at the same time is comparatively well suited for such an investigation. On cephalothorax we found a comparatively small number of scattered, rather short lines. On the abdominal tergites only a few rather short similar lines were found, which were extremely small on the small ninth tergite. On the large, apparently first, sternite there are four pairs, the grouping of which agrees with the view that this plate is really made up of two; the following well-developed sternites have four to five lines each; on the last three sternites which are so peculiarly developed in the male we have not found any lines nor any on the large anal valve; but on account of the uneven convexity of these pieces it is almost impossible to carry out an investigation of them in such a way that a negative result could be safely taken as decisive. On the inside of the basal joint of antennæ there are three long or even very long scattered lines, whilst a solitary short one is found on the outside; the second joint has five short or very short scattered lines on the inner side, and two on the outer side. The mandibles appear to have one near the insertion of palpus. The trochanterial and femoral parts of palpus have a line each on the outer side near the apex; the patellar part has one near the lower edge. We did not succeed in finding any lines on coxae of the walking limbs except on the first pair where one is found near the proximal extremity. We have besides particularly examined a leg of the

fourth pair and found short lines on the posterior surface of each joint, viz. three on femur, two each on patella, tibia, metatarsus and the last joint of tarsus, and one each on trochanter and the first joint of tarsus. On the anterior surface of trochanter there are two lines, but none on the front side of any other joint. A solitary transverse line was found on the upper surface, and another on the under surface of either branch of ovipositor, beyond their middle.

If in conclusion we take a general survey of the occurrence and peculiarities of these organs in the whole order Opiliones, we gather the following results. Regularly formed lyriform organs, properly so called, such as occur on several joints of the five pairs of appendages in Araneæ and at least on one joint of the locomotory limbs of Scorpiones, are not found in any Opiliones. On trochanter of the walking legs in Palpatores, and on the basal joint of antennæ in *Phalangium*, five or even more lines are found together forming a group of lines, but they are not arranged in regular order as to length, shape, or mutual distance in these groups; a few lines are also not rarely found near each other on the proximal joints of the limbs, but otherwise the lines occur solitary. Their length is different in different parts of the body and in different systematic divisions, but the minute expanded point where the nerve terminates is always near the middle of the line. Lines are generally, perhaps always, found on the dorsal shield of cephalothorax, they are always found in at least most abdominal tergites and sternites, always on the basal joint of antennæ, on the femoral part of palpi and on trochanter and femur of the walking legs, at least generally but perhaps always on their coxae as well. Lines may be found besides on the second joint of antennæ, on the mandibles, most of the joints of palpi, and on several, in Cyphophthalmi even in all, joints of the walking legs. If we compare this result with those obtained by Gaubert and supplemented by Hansen with regard to Araneæ, and with Hansen's results in regard to Pedipalpi, Scorpiones, Chelonethi and Solifugæ, we find that as regards the distribution and structure of the lyriform organs Opiliones approach more nearly to Amblypygi than to any other division, less to Oxopœi and Chelonethi, still less to Araneæ, but stand the farthest from Scorpiones where these organs only occur on the limbs, not to speak of Solifugæ, in which order they have hitherto been discovered only on antennæ. According to Hansen and Sörensen (*a*) lyriform organs are completely wanting in Palpigradi, and it will be pointed out in the sequel of this paper, that it has not been possible to find them in Ricinulei.

7. *The odoriferous Glands.*

The earliest mention of some Opiliones being remarkable on account of a peculiar smell is due to Latreille who in 1804 (*b*, p. 317) says of "Phalangium":—"plusieurs espèces ont une odeur très-forte de feuilles de noyers." But it was long before naturalists obtained clear knowledge of the glands which secrete the smelling matter. Latreille had indeed seen the orifices of the glands, but had mistaken them (*b*, p. 315) for a second pair of spiracles, to which they may perhaps be found to bear some resemblance. Treviranus (p. 25) and Tulk (p. 156) mistook them, in the common harvest spiders, for eyes, because in these species they are of dark colour and shine through the skin. This mistake was repeated in 1862 by Leydig although Gervais had already in 1849 (*b*, p. 19) stated with regard

to Laniatores, that these organs were odoriferous glands¹. But this statement was overlooked also by Krohn who in 1867 specially examined these organs and found that they were glands, without, however, recognizing their special function². Thorell (*a*) very properly utilized the fact that in some cases their openings are visible, whilst in other cases they are apparently wanting, as a character for the distinction of genera within the sub-order Palpatores. In 1879 Simon (*b*, p. 121) expressed his opinion thus: "il paraît probable que ces organes spéciaux sécrètent le liquide odorant particulier aux faucheurs," to which he adds on a subsequent page (p. 133): "plusieurs possèdent aussi, comme moyen de défense, un liquide odorant excreté par les orifices latéraux dont nous avons parlé: chez le Phalangium Opilio cette odeur rappelle celle du brou de noix." In the same year Sörensen (*b*, pp. 179—185) showed that these organs in Laniatores are odoriferous glands, and stated that when the animal is irritated, the glands often—together with the urine—secrete a liquid of a strong yellow colour caused by small drops of oil held in suspension in it, and of a sharp odour reminiscent of horse-radish, which irritates the eye of an observer examining the animal with a magnifier. Loman who was acquainted with Sörensen's anatomical investigation stated subsequently (*a*, p. 15) that he must leave the question of their function undecided as regards Phalangioidæ, but as both Latreille and Simon have stated in the passages above quoted, that the animals of this family also develop an odour, there can be no doubt as to the function of these glands. They do not secrete oil in *Phalangium*, at least not in *Ph. parietinum*.

We have mentioned the mistakes committed by earlier writers with regard to the odoriferous glands in the common harvest spiders, because one of them has been repeated with regard to Cyphophthalmi, the openings of the odoriferous glands together with a small surrounding space having been regarded by all previous authors as "stalked eyes." The mistake is not unnatural, because the openings of the glands are placed at the top of a pair of protuberances of varying height, of nearly conical shape, our "coni fœtidi"; the tops of these protuberances are generally rounded, and the spot where the opening is placed, is encompassed by a small more or less convex area, whilst the surrounding space is often rather depressed; in *Siro* and *Parasiro* this area is semiglobular and shiny and looks very much like an eye, when not very carefully examined. Besides, the great majority of the genera of the two other sub-orders of Opiliones which are better known, have their real eyes placed on protuberances, generally both on one and the same, but in some cases each eye is placed on a separate protuberance. To this must be added that the two genera of Cyphophthalmi which have been known the longest, *Siro* and *Parasiro*, are both without real eyes. In *Stylocellus*, which does possess a pair of eyes, they were overlooked by Westwood, who established the genus. Thorell, who discovered them and therefore counted two pairs of eyes in *Stylocellus*, had his suspicion roused at this number so unusual in Opiliones, but unfortunately he directed the suspicion against the real eyes, with regard to which he of course found it not justified. He expresses himself thus in speaking of *S. Beccarii* (*c*, p. 26, the note): "Maculas duas succini coloris, quas oculos sessiles judico, foramina

¹ He says with regard to the liquid: "su olor particular y muy fuerte, que imita al del ácido nítrico ó al de las avellanas rancias. La anatomía de algunos individuos vivos nos ha probado que este líquido estaba contenido en dos bolsas ovales, una à cada lado del céfalotorax, y que salia cerea de la cabeza cuando el animal se hallaba perseguido ó

en peligro."

² These glands are often (in Phalangioidæ) called the glands of Krohn, but this name ought not to be used, not only because Gervais had recognized their true nature many years before Krohn, but also because their function is now known, and they ought to be named after that.

supracoxalia (orificia glandularum Krohnii) fortasse credideris, sed nullam earum aperturam detegere potui, et ex cute nitida dura leviter convexa constare videntur, quae haud dubie *cornea oculi* est." Guided by the communication of Dr. Purcell, which we have mentioned in the preface, it was of course easy for us to ascertain the real state of things, amongst other means by finding the glands both in *Stylocellus Beccarii* (*og* in Pl. I., fig. 1 *s*) and in *Purcellia illustrans*. The glands are rather large, the dimensions being in *S. Beccarii* 1·13 by 0·63 and 0·45 mm., and they resemble most nearly a short bag with thick sides and a rather long neck, which is prolonged through the conical protuberance just described, and opens at the top of the latter. The orifice itself has the form of a fissure placed aslant of the longitudinal axis of the body, the anterior extremity being nearer to the middle line than the posterior extremity. In *Purcellia* the fissure is easily detected (Pl. III., fig. 4 *b*) when the top of one of the cones is cut off and placed under the microscope; but in *Stylocellus Beccarii* (Pl. I., fig. 1 *e*) and in *Siro duricorius* (Pl. IV., fig. 3 *b*) it is by no means easy to see the fissure on a microscopical preparation on account of the light colour of the surrounding chitine. In *Pettalus cimiciformis*, which we have not had an opportunity of dissecting, it is fairly easily seen; and in the majority of species we succeeded as a rule by means of a powerful magnifier in seeing a small furrow, which indicates the place of the fissure. In *Ogovia* the area which surrounds the orifice of the odoriferous gland has no resemblance to an eye; *conus foetidus*, which is depressed towards the top, shows a large fissure which extends in the direction of the longitudinal axis of the body right across the top of the cone¹. *Coni foetidi* are never placed on the very edge of cephalothorax, though in *Stylocellus*, *Ogovia*, *Siro*, and *Parasiro*, they stand so near its lateral margin, that the base of the cone touches it, but in *Pettalus* and *Purcellia* they stand far from the edge. We regret being unable to give any information about the structure of the glandular stratum of the odoriferous gland, because the state of preservation of our specimens did not admit of a proper colouring of the nuclei.

In *Laniatores* the openings of the odoriferous glands are always situated just inside the border of cephalothorax and have generally the form of a fissure differently shaped in various genera; generally the fissure is narrow and placed a little slantingly across the longitudinal direction of the body; the surrounding space is often slightly convex (see Sörensen *b*, Pl. II., fig. 22); in some cases it is partly or even completely hidden by small processes on coxae.

In *Ischyropsalidoidæ* and most genera of *Phalangiodæ* the orifice is easily seen and always in the shape of a longitudinal fissure placed in a slightly cup-shaped area of which the margin is pretty firmly chitinized, on or close to the lateral border of cephalothorax. Generally this area and the opening are large, but in *Ischyropsalidoidæ*, *Leiobunum*, *Gagrella* and allied genera they are rather small. In *Sclerosoma* and congeners, for instance in *Mastobunus*, in *Nemastomatoïdæ* and *Troguloidæ* the openings of the odoriferous glands are hidden. We have examined a representative of each of these types. In *Mastobunus tuberculifer* Luc. the opening is a very small fissure placed in the lateral edge of cephalothorax which is bent perpendicularly downwards, and it is hidden because the upper portion of the free distal part of the first coxa protrudes strongly upwards. In *Nemastoma lugubre* O. Fr. Müller, the opening is clearly discernible only when the first coxa is removed; it is then seen that a very small portion of the dorsal shield, above the free extremity of

¹ Something similar is probably the case in "*Siro*" *cypropselaphus*, as Joseph who established the species (*c*, p. 20) says that it is without eyes ("augenlos").

the first coxa, is bent inwards, and on this part an oval, raised, firmly chitinized ring is seen surrounding a somewhat depressed area, where the skin is thinner, and in which a short fissure appears. When one has become familiar with the appearance of this region the prominent external part of the oval ring may be recognized above the coxa without dismembering the animal. In *Trogulus rostratus* we have found a somewhat similar structure; but only the external half of the oval ring is here developed, and it is thinner and less firmly chitinized; it is placed on the lower face of a somewhat convex part above the first coxa and is visible only when the free distal part of coxa is bent strongly downwards, because the erect slender spines on coxa standing in a close row form a complete screen round the lateral depression between the lateral border of cephalothorax and the basal portion of the free upper surface of coxa. According to Sörensen (*b*, p. 184 note) the small elongated gland is found in the thicker portion of the lateral part of cephalothorax. On the strength of these facts it may be considered a character common to the whole order that a pair of odoriferous glands, stink glands, are found in cephalothorax.

There is, however, one more point in connection with the odoriferous glands which deserves consideration, viz. the position of their openings, which is of interest on account of its systematic value within the order. In all Palpatores the orifices of these glands, as well as the glands themselves, are placed above the end of the first pair of coxae. In Ischyropsalidoidæ, *Leiobunum*, *Gagrella*, and those other genera where the openings are smaller than the width of the coxa they are plainly enough placed above the posterior part of coxa. In all Laniatores the openings are situated above the anterior half of the terminal part of the second pair of coxae. In all Cyphophthalmi, finally, they are placed above the space intervening between the terminal parts of the second and third pairs of coxae. These positions are constant whatever be the shape of cephalothorax and whether coni fœtidi are placed nearer to or farther from the lateral border of cephalothorax. In *Stylocellus*, the only representative of Cyphophthalmi endowed with eyes, these are placed closely, or at a short distance, in front of coni fœtidi, but in Ischyropsalidoidæ and, particularly, in Phalangioidæ, the protuberance on which both eyes are placed stands at a considerable distance, obliquely behind the openings of the odoriferous glands. This difference in the relative positions of these two sets of organs, is certainly very great, but it will be seen on examination that they both belong to that part of the body which must be looked upon as constituting the head in Arachnida, that is to say, that part of the body which is formed by those segments to which the eyes and the first four pairs of appendages belong. Unfortunately no trace is visible in Cyphophthalmi of a boundary between the segments to which the second and third pairs of legs belong, but, as we have already pointed out, coni fœtidi are placed opposite the interspace between the second and third pairs of coxae, that is, as far back as would be possible at the lateral border. We would therefore observe that, in spite of the difference as regards the position of the odoriferous glands, which we have just described, and which certainly is, at least apparently, very considerable, there is no room for any doubt as to their being homologous organs all through the three sub-orders, seeing that considerable changes in the relative position of the parts of cephalothorax manifestly take place during the development of the animals, at least in Phalangioidæ. This is evident from the fact that in this family the eyes, which in all Arachnida, nay in all Condylopoda, belong to the first segment of the head (the "procephalic lobe" in Arachnida), are placed more or less closely in front of the foremost transverse

groove on cephalothorax, which marks the boundary between head and thorax. With regard to this point we refer to our remarks on pp. 5, 6 concerning the boundaries of cephalothorax and the two last thoracic segments belonging to it.

8. Remarks as to the other interior Organs.

The information hitherto available on the interior anatomy of Opiliones is very limited and refers only to a few species. Amongst Laniatores the anatomy of only three species has been published by William Sörensen (*b*), these belonging to the two families Gonyleptoidæ and Cosmetoidæ, which are not nearly related to each other¹. Amongst Palpatores scarcely any have been examined respecting their interior structure, except the commonest European harvest spiders which belong to Phalangioidæ. The principal authors as regards this family are Treviranus, Tulk, Loman (*a*), and, on the subject of the alimentary canal, Plateau. The sexual organs of Phalangioidæ alone have been repeatedly examined by Lubbock, Krohn (*a*), Blanc, de Graaf, and Sörensen (*c*), the principal paper being that of de Graaf. Only a few scattered notices have been published by Lubbock and Sörensen (*c*) concerning a few species of other families than Phalangioidæ. As the terminal parts of the sexual organs offer characters of special systematic value, we have especially endeavoured to supplement the knowledge of these organs in Laniatores and Palpatores, by means of fresh investigations. Concerning the inner structure of Cyphophthalmi no information has yet been published. Unfortunately the specimens which we have been able to examine were not in such a state of preservation, that we could enter on an investigation of the histological structure of the organs; even in the topographical anatomy of these animals there are several points on which we could have wished to give fuller information, and the anatomy of the dorsal vessel and the nervous system we have not been able to study. Nevertheless, we venture to hope that what we have to communicate will prove of interest, and particularly that it will serve to fix the diagnosis of the order and its sub-orders respectively.

9. The Alimentary Canal.

The alimentary canal, which is straight in all Arachnida, consists, according to Plateau and Loman (*a*, p. 34), in Palpatores of four divisions: a narrow œsophagus, a small anterior portion, a wider and capacious middle portion, the mid-gut, which is the largest part of the alimentary canal, and a less capacious anal portion. In Laniatores and Cyphophthalmi the alimentary canal consists probably of the same divisions of similar dimensions, because the fact that Sörensen did not notice the anterior portion in Laniatores, and that we have not observed it in Cyphophthalmi, is no doubt owing to the small size of that division.

The most remarkable feature of the alimentary canal in Opiliones is the presence of the large diverticula which branch off from the anterior part of the mid-gut and which are joined by connecting tissue to the sides and dorsal surface of this as well as of the anal division, so that these divisions are covered by diverticula, excepting a broader or narrower part of their under surface, and thereby often assume a strange appearance. In

¹ Loman mentions that he has studied the anatomy of other families of Laniatores, but he has not yet published more than a single result of his investigations.

Laniatores Sörensen (*b*, pp. 167, 168) found four pairs of diverticula, afterwards Loman (*a*, p. 36) found four pairs in Phalangoidæ, and we can confirm his statement¹. We have found the same number in Cyphophthalmi (*Stylocellus* and *Purcellia*) as also in a species of *Trogulus*, which we dissected on purpose. This number may therefore be considered characteristic of the whole order. In Cyphophthalmi the diverticula are quite without branches. The figures 1*s* and 1*t* on Pl. I. show the position of the diverticula (*di*) in an animal in which the two anterior pairs had been ruptured by the opening of the body, close to their rise from the alimentary canal. The first pair is as usual the shortest and is confined to the dorsal surface of the alimentary canal, where each of them forms a short but abruptly bent curve. The second pair winds round to the under surface of the alimentary canal, passing under the first pair; the third and fourth pairs (*di*³ and *di*⁴) are essentially confined to the dorsal surface, though the third pair also envelops the canal a little from the sides. According to Treviranus, Tulk and Plateau diverticula in Phalangoidæ are divided into a great number of lateral lobes, and as Sörensen found that the two anterior pairs in Laniatores are undivided, and the last two pairs subdivided only once, he (*d*, pp. 575—579) thought that this point of structure might offer a distinguishing character between Palpatores and Laniatores. But our investigation of *Trogulus rostratus* has shown us that this does not hold good. Of the four pairs of very slender diverticula found in that species the two first pairs are undivided and proportionally short, whilst the two posterior pairs are only a little branched, but so extremely long that their length much exceeds that of the whole alimentary canal; they form large loops, particularly on the dorsal surface of the latter, so as to produce an appearance which reminds us of the surface of the cerebrum in a mammalian. Since this was written Loman (*g*, p. 171) has briefly stated that also amongst Laniatores he has found the diverticula (? all) to be branched in some forms; unfortunately he does not give the names of these forms.

Several authors have said that the diverticula which branch off from the mid-gut of the alimentary canal in many Arachnida, serve for the reception of food. This, however, appears to us very doubtful, and as regards Opiliones we may affirm with certainty that it is not the case. The middle and anal divisions of the alimentary canal may be found quite filled with more or less digested portions of food, fragments of animals which are easily recognized by the broken pieces of chitine which are contained in them; but such are never found in the diverticula, as indeed Tulk and Plateau (p. 15) have already pointed out as regards *Phalangium*, and Sörensen as regards Laniatores. The last-named writer says (*b*, p. 170) that diverticula "are found distended just when the alimentary canal is empty of food, after the animal has been fasting through a couple of weeks."

10. Organs of Excretion.

As we are unable to give a satisfactory account in all respects of the excretory organs in Cyphophthalmi, we prefer first to mention the structure in the other sub-orders of Opiliones. Both Treviranus and Tulk observed only some loops of the organs of excretion and therefore misinterpreted them. Treviranus described them as "Gallengefäße," biliary ducts,

¹ Plateau had already before indicated three pairs of diverticula in Phalangoidæ; afterwards Rössler concluded (p. 676) that there were six pairs in these animals. It should

be noted, however, that what these two authors refer to is not, strictly speaking, the number of diverticula, but the number of their openings into the alimentary canal.

whilst Tulk, who thought that he had noticed two pairs, was of opinion that they "perhaps exercise some salivary function." Plateau was the first author who found organs in *Phalangium*, which he declared to be excretory organs, viz. one pair of tubes which according to his investigation opened into the rectum.

Sörensen, on the contrary, found in *Laniatores* (*b*, p. 171 *seq.*) a pair of very delicate, undivided, very long tubes of which the inner, blind extremity was situated in front of the posterior borders of the third pair of coxae; from thence they pass along the alimentary canal, forming several loops on the upper as well as on the under surface of it, and finally open into a pair of large elongated bladders at a rather acute angle. The bladders are situated under the alimentary canal and open to the outside in the margin of the dorsal side of cephalothorax just behind the orifices of the odoriferous glands, above the second pair of coxae. These openings, which are very small, can be seen from the outside in many *Laniatores*, amongst others in all *Gonyleptoidae*. Later on Loman (*a*, pp. 43—49) found a pair of tubes in *Phalangium* which were said to form an elongated loop of which both ends opened into a pair of urinary bladders, situated in the same place as in *Laniatores*. This statement was fully confirmed by Rössler (p. 679). Sörensen, however, afterwards investigated the matter in *Phalangium* and satisfied himself (*c*) that these two authors had failed to see the real openings of the tubes into the urinary bladders, and that only one of the extremities of each of these tubes opened into a bladder, whilst the other is closed¹, consequently that the arrangement so far was the same as in *Laniatores*. Loman had not at that time succeeded in finding the orifices of the urinary bladders on the outer surface of the body, nor did either Rössler or Sörensen succeed in doing so. Afterwards, however, Loman (*c*), whilst admitting that only one extremity of these tubes opens into the bladders, announced that the outer opening of the bladders in a *Gagrella* is situated in the space between the third and the fourth coxa. Sturany has confirmed this, having found (p. 15) in a *Platylophus* that the urinary bladders open in the posterior wall of coxae of the third pair of legs. We have examined the structure in *Phalangium opilio*. The opening is here placed a little nearer to the proximal than to the distal end of the third coxa, near the anterior margin of the strip of thin rather broad skin which forms the bottom of the space between the third and the fourth coxa. We must add that these glandular tubes are thicker and much shorter in *Palpatores* than in *Laniatores*. The urinary bladders into which they open are easily seen on fresh specimens, when distended by the liquid, but in spite of their size they are not easily found on specimens preserved in alcohol, apparently because they always collapse, being emptied when the animal is killed in a liquid. It is certain that in *Cyphophthalmi*, as in other *Opiliones*, there are no other tubular organs in connection with the alimentary canal than the diverticula of the mid-gut. From this it follows that *Opiliones* do not possess any organ which can be considered as *fully homologous* with the Malpighian tubes of Insects, which open into the rectum.

In the *Cyphophthalmi* which we have examined we have found that these glandular tubes, of which a portion is figured in Pl. I., fig. 1 *t*, *t*, are very short, and in particular shorter than those in *Palpatores*. We have not been fortunate enough to see the bladders, but when we took out the tubes, we succeeded in getting one of them free in its entire

¹ As it has been stated by Faussek in a paper which we have been unable to consult, that the glandular tube in *Phalangium* terminates interiorly in a sac, we should add

that in all the specimens examined by us, belonging to any of the three sub-orders, the interior end of the tube was found closed.

length, with an adherent piece of the bladder, which certainly was too small to give an idea of the size of the bladder, but it was large enough to show us, who were familiar with the relation between the tubes and the bladders, that the tube does open into a bladder. Under the circumstances we cannot of course say with perfect certainty where the orifices of the bladders are situated, but on a dermoskeleton of a female *Purcellia*, which had been cleaned by means of caustic potash, we found a pair of holes, which we cannot doubt are the openings of the urinary bladders; they are placed between arculi genitales and the most proximal part of the third pair of coxae, and we have reason to believe that both in the male *Purcellia* and in the other genera these openings are situated in or near the same place. It follows that in this point of structure Cyphophthalmi agree essentially with Palpatores.

In conclusion we would say a few words with regard to the function of these so-called coxal glands in Opiliones, and their homological relations to the excretory glands in other Condylopoda. One of us, who, as far as we are aware, was the first to find them in any Arachnidæan, viz. in Opiliones Laniatores, described them as "Organs of Excretion, Kidneys or Malpighian tubes." There can be no doubt that in Opiliones they are really excretory organs, because such organs would otherwise be entirely absent from these animals. This is also the view taken by Loman in his last paper on these organs (*c*), although he had attempted in vain to demonstrate the presence of urinary products in them. "Coxal glands" have been found in all orders of Arachnidæa (amongst Acari, at least in the sub-order Notostigmata, see With, p. 164), and also in Xiphosura. Many authors consider them to be the homologues of the "segmental organs" (the nephridia) of Annelida. We do not venture to follow this opinion for this reason, amongst others, that it appears to us too hazardous in view of the great distance which, according to our opinion, exists between Annelida and Condylopoda. We may on this point refer to what one of us, H. J. Hansen, replied to the question addressed to him amongst others by *Natural Science*, viz. "Are the Arthropoda a natural group?" (*Nat. Sc.* 1897, pp. 97—117). In discussing the homology of these organs, we prefer on the contrary to confine ourselves to Condylopoda.

It is very generally said that though the "coxal glands" in younger or not full-grown animals possess an open outlet on the surface of the body, yet in adult individuals these openings are closed. We must confess to entertaining very grave doubts concerning the correctness of such statements, but we prefer not to enter further into that question on this occasion. As regards the position of these openings, whether they are ultimately closed or not, we refer to the paper by Sturany on the coxal glands, in which he has collected all that at that time (1890) was known on the subject. He knew that their openings are situated at the fifth pair of limbs (the third pair of legs) in Scorpiones, Araneæ Theraphosæ, and in "Phalangioïdæ," which latter term he employs for Opiliones; but as he found at the same time that in Araneæ veræ, and "probably," as he says, also in Solifugæ¹, they are placed opposite the third pair of limbs, he adds that "the question now arises whether we are to look upon the coxal glands as representing one nephridium or more"², a question which we should prefer to formulate thus: are these organs to be considered fully homologous in all Arachnidæa and Xiphosura? In seeking a reply to this question it

¹ This was afterwards confirmed by Bernard who (p. 377) states that in Solifugæ they are situated between the coxae of the third and fourth pairs of limbs.

² "Es entsteht nun die Frage, ob wir in den Coxaldrüs'en ein einziges [Nephridium] oder derer mehrere zu suchen haben."

must, however, be borne in mind, that Araneæ veræ and Solifugæ are by no means the only Arachnida in which these orifices are known to be situated in another place than at or opposite the fifth pair of limbs. We have already stated that in Opiliones Laniatores their place is above the fourth pair of limbs. It is true that we would not venture to maintain absolutely that this place in reality belongs to another segment than that to which the fifth pair of limbs belong, behind which these glands open in Palpatores and most probably in Cyphophthalmi. Every indication of a division of cephalothorax into segments having disappeared in Laniatores there is a possibility, though not much probability, that the place where the opening is situated belongs to the first thoracic segment which carries the fifth pair of limbs (the third pair of legs). But on the other side we should be still less inclined to look upon this question as answered in the affirmative by the position of the orifices in Laniatores. There remains, however, the case of Palpigradi (*Koenenia*) where the matter is altogether beyond dispute: Grassi has already mentioned (p. 161, fig. 13) that he had found a paired long tubular gland, which “perhaps” had its orifice in front of the third pair of limbs. Grassi looked upon this pair of glands as corresponding to Krohn’s glands, that is the odoriferous glands in Opiliones Palpatores. In the course of the investigations we carried out in preparing our little paper on this type, on which occasion we do not otherwise attempt to study the interior anatomy, we were once fortunate enough to see this gland and found that according to its structure it was, as we expressed ourselves, “exactly the same as the excretory ones in Opiliones.” Partly relying on this and partly, though in a lesser degree, on the strength of Grassi’s suggestion concerning the position of the orifices, which we had not the good luck to see, we stated concerning this pair of glands that “there can scarcely be any doubt that it corresponds to the excretory glands which in the higher Arachnida...just have their orifices on the sides of the cephalothorax, and not—like the Malpighian tubes of the Insects—in the rectum.” Miss Aug. Rucker (p. 626), who does not seem to have understood our opinion concerning these glands, as she does not mention it, though she was acquainted with our paper, has demonstrated that they “terminate between the second and third pair of appendages.” But in Palpigradi the thoracic segments which carry the fifth and sixth pairs of limbs are plainly separated from that unsegmented portion (the head) which carries the first four pairs of limbs, on which these glands therefore open. In view of this fact it is beyond dispute that these glands in *Koenenia* cannot be *fully* homologous with those which in other Arachnida open at the fifth pair of limbs.

According to our view there are consequently in Arachnida¹ (apart from Acari) two morphologically different sets of excretory organs, one opening behind the third pair of limbs which is developed in Palpigradi, Pedipalpi², Solifugæ, Araneæ veræ, and Opiliones Laniatores, and another opening at the fifth pair of limbs which is developed in Scorpiones, Chelonethi (Pseudo-scorpiones)³, Araneæ Theraphosæ and Opiliones Palpatores, and probably Cyphophthalmi⁴.

¹ The excretory organs of Ricinulei are not known, as indeed is the case with nearly the whole of their internal structure.

² In Uropygi (*Thelyphonus*) Adensamer found that these organs open at the base of the coxae of the third pair of limbs, whilst according to Laurie the orifices are placed behind the latter; Tarnani also observed their orifices in embryos behind the third pair of limbs.—Bernard found the openings behind

the third pair of limbs in Amblypygi (*Phryinus*).—They have not been found in Tartarides (*Schizomus*).

³ Bernard has found the openings behind the coxae of the fifth pair of limbs.

⁴ It was only after the text of our treatise was finished that we became acquainted with Gough’s paper on the development of *Admetus pumilio* (a species of Amblypygi). Like his predecessors he has found “coxal glands” at the

But in Crustacea, that class of Condylopoda, to which in our view Arachnida are more nearly allied than to any of the other classes, the excretory organs open, as is well known, on the outside itself of the body; but neither in this case are they *fully* homologous throughout the class, because in Malacostraca (with *Nebalia*) and at any rate *Cythere* they open on the second pair of antennæ, whilst the "shell gland" in Phyllopoda and Cumacea opens at the second pair of maxillæ.

In Insects and Myriopoda the excretory organs are the Malpighian tubes, which, as is well known, are always connected with one and the same part of the body, viz. the last segment of the latter, opening as they do in that portion of it which is turned inwards and forms the rectum¹.

The fact therefore is that in all Condylopoda the excretory organs open on the surface of the body (the skin or ectoderm), but belong to different portions of it in different groups. We cannot therefore consider them *fully* homologous organs throughout the series, nor even in all groups of Arachnida.

11. Organs of Respiration.

Cyphophthalmi, as indeed Opiliones generally, possess one pair of tracheæ which are ramified into very numerous branches and supplied with filiform spiral thickenings, and which open on the apparently first, really second abdominal sternite. In all Cyphophthalmi with which we are acquainted the spiracles are plainly visible on the ventral surface of abdomen. They are shaped like a narrow band, more or less curved, so that in *Siro* the ends almost touch each other whilst in *Stylocellus (Beccarii)* the spiracle (Pl. I., fig. 1 n, b) is formed like a somewhat irregular semicircle. The bridge between the skin enclosed by the spiracle and the skin around it is directed backwards, as in *Siro*, or at the same time somewhat outwards, as in *Purcellia*. Although we have not succeeded in forming a clear conception of the extremely complicated structure of the spiracles in the few specimens which we have been able to examine, we may affirm that they are always latticed, that is to say furnished with close transverse bars across their opening.

In Laniatores the spiracles are never yawning openings; in the great majority of them, at any rate, they are of the type described by Sörensen in the first representatives of this sub-order examined by him (b, p. 149, Pl. II., fig. 14), viz. semilunar, latticed, the crossbars being furnished with small closely placed tuberosities.

base of the third pair of limbs, but at the same time he was able to prove the existence of such at the bases of the fourth pair of limbs at an early stage of development. These latter were only in a rudimentary state and very soon atrophied. It will be seen that Gougl's observations afford a further proof of the correctness of our view.

¹ It is very doubtful whether organs which *fully* correspond morphologically to the Malpighian tubes in Insects occur at all in any Arachnida. Certain slender tubes which open into the alimentary canal in Araneæ and others have been looked upon by earlier authors as homologous with the Malpighian tubes in Insects, but more recent writers at any rate are more inclined to think that they are connected with

that part of the alimentary canal which is formed by the entoderm. With regard to Araneæ we may refer to a short but very interesting paper by Loman (b) in which he has placed it beyond doubt, that in that order the tubes in question open into the mid-gut, not into the rectum, and on this ground maintains that they are not real Malpighian tubes. Wagner has already (p. 137) emphatically maintained that Arachnida upon the whole do not possess organs that are the homologues of the Malpighian tubes in Insects. We are inclined to adopt this view, but are of opinion that it is perhaps a little too soon to consider it fully established before it has been decided what character the structure has in certain Acari.

In Palpatores, on the contrary, the spiracles offer more variety. In all Phalangioïdæ they are placed in the space between the fourth pair of coxae and abdomen, they are large, rather wide open and visible when the coxa is turned a little forward¹. In the other families, they are sometimes placed in this groove, as in Nemastomatoidæ and in Troguloidæ, excepting *Amopaum*; in others they are visible closely behind this groove as in Ischyropalidoidæ. But in all these three families, the spiracles are generally small, always latticed², or perhaps even formed like a sieve; they have the shape of a band, which only in *Ischyropsalis* is of considerable width, but is always curved, the curvature pointing backwards; generally they are only slightly curved, but in *Ischyropsalis* so much that they must be described as semilunar. We draw attention to this because the structure of the spiracles affords more comprehensive systematic characters within Palpatores, than those earlier used by Sörensen (*d*).

The two very small spiracles which Hansen has pointed out (*b*, pp. 198—204) on tibia of all four pairs of legs in several Phalangioïdæ, and which according to Loman (*e*) become open only towards or at the full sexual development of the individual, occur only in that family of Palpatores. We repeat this here, though it has been stated already by Hansen, because we have investigated this point in many more species than Hansen had then examined; they are found in all the genera of Phalangioïdæ which are represented in our Museum; but in none of the other families or sub-orders is there any trace of them.

12. *The Sexual Organs.*

The Cyphophthalmi differ from the other sub-orders far more in the sexual than in the other interior organs, and this is particularly the case with their terminal portions, penis and ovipositor. In all Opiliones female sexual organs comprise besides ovipositor, an unpaired but symmetrical curved ovary which occupies a transverse position underneath the alimentary canal, and a pair of oviducts arising, one from either end of the ovary. These combine into a common canal, of which a part is expanded so as to form the so-called "uterus," in which a not inconsiderable quantity of eggs remain for some time in order to attain their final development and be clothed with an eggshell. The terminal portion of the common oviduct is continued into ovipositor as far as the place where the latter is cleft. Ovipositor is furnished with receptacula seminis. From the fig. 1 *r*, Pl. IV., which represents the female sexual organs below the "uterus" (*u*) in *Purcellia*, it may be seen that they do not differ from what is found in Laniatores³ or Palpatores⁴ except as regards the dimensions, which are a little different.

The male sexual organs in Opiliones comprise besides penis an unpaired symmetrical testis, similar to the ovary in shape and position, and continued at either extremity in a delicate vas deferens; these two vessels unite into a vesicula seminalis of elongated shape, which enters penis. In Cyphophthalmi vesicula seminalis is rather wide and very long,

¹ According to Simon (*b*, p. 158) the spiracles are "cachés" in *Sclerosoma* and allied genera, but "apparents" in the other Phalangioïdæ.

² While referring to Sörensen (*b*, p. 149, note 3) we wish to observe, that by examination of a *Trogulus rostratus* we have convinced ourselves that it is a mistake, undoubtedly due to a defective preparation, when he states that the

spiracles in *Trogulus sinuosus* are not latticed; what he describes as thicker lines in the membrane are the bars. Nor can there be any reasonable doubt that he has made the same mistake in *Amopaum*.

³ See Sörensen (*b*).

⁴ See Krohn, Loman (*a*) and particularly de Graaf.

rolled up in numerous windings (Pl. I., fig. 1 *u*, *v*), which fill the space on the ventral side of the alimentary canal between the diverticula of the latter. In this respect Cyphophthalmi agree with Laniatores¹ whilst differing from Palpatores². There are two points, however, which are not unessential and with regard to which Cyphophthalmi offer peculiarities constituting a difference from what occurs in the two other sub-orders. In these latter the distal portion of vesicula seminalis is narrowed and the first part of the narrowed portion is developed as a pars ejaculatoria, the wall of the canal, which in Palpatores is chitinized, being surrounded by fairly powerful muscles³. This pars ejaculatoria is not developed in Cyphophthalmi, nor is the distal portion of vesicula seminalis here abruptly narrowed. But the distal extremity of vesicula seminalis is furnished with two blind appendices, which are not found either in Laniatores or in Palpatores. These rather elongated appendices (Pl. V., fig. 2 *o*, *k* and *k'*) are united with and open into vesicula seminalis just behind the base of penis. We have, unfortunately, not been able to make out the function of these appendices with any certainty.

Ovipositor is, at any rate in the large majority of Laniatores, a proportionally very short⁴ and thick organ (Pl. VI., fig. 8 and 9); it is not articulated, but the rather soft wall is irregularly folded transversally when the organ is not in use. At the end it is divided into two lateral lips together carrying ten setæ which are bent inwards towards the middle, viz. six on the dorsal and four on the ventral part⁵. Of the two most peculiar families amongst Laniatores, viz. Oncopodoidæ and Triænonychoidæ, we have examined the ovipositor in three genera by means of dissection. We found that it deviates from the structure generally met with in Laniatores only in one feature, viz. the number of setæ. In *Pelitus* sp. (of the fam. Oncopodoidæ) thirty short almost aculeiform curved setæ are arranged in a whorl which is interrupted above, below, and on both sides. In *Triænonyx Valdiviensis* W.S.⁶ fourteen long and thick setæ are arranged in a whorl rather distant from the end of ovipositor. In the ovipositor of *Acumontia echinata* Poc. two short aculeiform setæ are placed near the apex, and at some distance from it between thirty and forty long setæ are arranged in a whorl which is rather irregular, being in some places approximately double and broadly interrupted on both sides (Pl. VI., fig. 10).

In Palpatores ovipositor is more or less long and its distal portion always cleft in the middle plane. It presents, however, two rather different types, and we must therefore deal with it at greater length. In Phalangioidæ ovipositor is a long tube, generally a little shorter than half the length of the body: it is composed of rings varying in number in different species⁷ and connected with each other by means of very much softer skin.

¹ See Sörensen (*b*).

² In reality the structure is known only in Phalangioidæ through the authors mentioned, and in Nemastomatoidæ through Lubbock.

³ In those Laniatores where the structure of these parts is known, these muscles are annular; in most Palpatores they have a spiral course (see de Graaf, pp. 46, 47, Pl. XIII. fig. 62), but in *Nemastoma argenteo-lunulatum* E. S. they are annular, and in *Platybunus corniger* Herm. the last fibres have that course.

⁴ That is to say, when the organ is *in situ*. Of course it appears much longer when protruding together with the sheath surrounding it, as is often the case with specimens

preserved in spirit of wine.

⁵ In *Cosmetus* and *Gonyleptes* (*sensu latiore*) the setæ are placed on rounded longitudinal ridges separated by rather deep folds, of which those that cross the extreme part of the organ are the most marked, but in *Maracandus* E. S. no such folds are found.

⁶ We have to thank Prof. Dr Kraepelin for the permission to examine this form.

⁷ According to de Graaf the numbers of these joints—apart from the cleft extremity—are: 35—40 in *Phalangium opilio*, 30—35 in *Ph. parietinum*, and 19 in *Leiobunum rotundum*.—In *Gagrella minax* there are 29 joints and in *Sclerosoma monoceros* 14.

According to de Graaf they consist of a dorsal and a ventral half; and as he has already noticed, they become less distinct, or even at last quite effaced, in the hindmost part. The apical part of ovipositor is cleft into two lateral portions, consisting each of three very movable joints, of which the terminal one is considerably longer than the others. Thus the distal extremity of ovipositor is converted into a kind of soft forceps with broad blades. Of the rings which compose the trunk of ovipositor, those near the base have no setæ, but the others are furnished with them, placed in whorls round the organ and increasing somewhat in number and length towards the end (comp. de Graaf, pp. 61, 62). On the joints of the forceps the setæ are considerably longer; on each of the first two joints there is only one whorl of them, but on the terminal joint there are three whorls, the last consisting of three setæ, one apical, one dorsal, and one ventral. But besides these setæ, the terminal joint of the forceps is furnished with a wart-like prominence placed on the outer side near the end, connected with the forceps by means of an articulation, and carrying a pencil of short setæ or spines. Both these and the other setæ on the forceps are organs of feeling which receive nerves from a ganglion in the extreme joint of the forceps (see de Graaf, p. 80, and Sörensen, c, fig. 18). Concerning the lyriform organs on ovipositor in Phalangioidæ we refer to what was stated above in section 6, p. 40.

In the other three families of Palpatores ovipositor exhibits a structure not a little different from that just described. In the first place it is never so long as in Phalangioidæ, but at the same time it is thicker, not only in proportion but absolutely. In the next place the division into rings, which is seen in Phalangioidæ, though more or less indistinct in the hindmost part of ovipositor, must be said not to exist in the other families excepting on the cleft extremity or forceps, and even on this, when we think ourselves able to distinguish two joints, these are by no means sharply separated. In *Ischyropsalis dispar* and *luteipes* they are so indistinct that we have not represented them on our figure. In these three families, moreover, ovipositor differs from the same organ in Phalangioidæ in being without the pair of warts covered with setæ which are found in the latter on the sides of the terminal joint of the forceps near the apex, and forceps is very short. Finally the chitine is always rather thin apart from the spines occurring on ovipositor, which consequently is more or less soft. In *Ischyropsalis dispar* and *luteipes* ovipositor is smooth except for the short setæ and fine hairs near the end, the disposition of which is represented on Pl. VI., fig. 3. In Nemastomatoidæ (*N. lugubre* and *argenteo-lunulatum*) the two distal thirds of ovipositor (Pl. VI., fig. 5) are furnished with rather long setæ, placed on broad but very low bases. The majority of the setæ on the forceps are considerably longer than those on the trunk of ovipositor; those on the very end are much shorter than the others. In Troguloidæ ovipositor is equipped with numerous strong spines, which, however, are fewer and less strong near the base, but somewhat longer on the joints of the forceps. Those on ovipositor itself are inserted on very high conical prominences, which where they stand close together (Pl. VI., fig. 7) are broader at their bases than the interspaces between them. On the forceps the spines are longer, but their bases are very low. As in *Nemastoma* the setæ which occupy the apex of ovipositor are shorter than the others.

In Cyphophthalmi ovipositor bears not a little resemblance to that of Phalangioidæ. Not only does it terminate in a forceps, which must be called long, particularly as its blades are not divided into joints, but the trunk is composed of joints which are all quite distinctly marked but vary considerably as to number in different species; there are 37 in

Purcellia illustrans, 25 in *Siro duricorius*, 8 in *Parasiro corsicus*, in which species ovipositor is accordingly much shorter and proportionally thicker than in *Purcellia*. The joints of the trunk, apart from the terminal one, do not differ much in length, as may be seen on the figures (Pl. IV., fig. 1 *u*; Pl. V., fig. 2 *p*). The hindmost joint or the two hindmost ones are without setæ; of the remaining joints the first (*Parasiro*) has, or about the first half of them (*Purcellia*) have each, a circle of six setæ, the remainder have a circle of eight setæ each. The setæ increase in length towards the anterior extremity. In those genera which we have examined the blades of the forceps (*f*) are not alike in this respect. In *Purcellia* (Pl. IV., fig. 1 *v*) there are three pairs of lateral setæ, four pairs of dorsal ones and four pairs of ventral ones, which are not all disposed in the same way; in *Siro* (Pl. V., fig. 1 *o*) there are three pairs of each kind, lateral, dorsal, and ventral; the arrangement in *Parasiro* may be gathered from our figures (Pl. V., fig. 2 *p* and 2 *q*) which represent ovipositor both from the dorsal and the ventral side. In them all the blades of the forceps carry, besides those indicated, three long apical setæ of which the longest is directed straight forwards and in *Purcellia* and *Parasiro* is inserted on the extreme end of the blade, which is somewhat contracted; one of the two others is placed on the upper surface, the other on the ventral surface; they are directed forwards but at the same time point a little outwards. In *Purcellia* and in *Siro* there is found on the exterior side near the end of each blade a very peculiar heavy bristle or process (*p* in Pl. IV., fig. 1 *v*; Pl. V., fig. 1 *o*), joined to the forceps by articulation; it is directed a little outwards and divided into seven branches, which are not connected with the main stem by articulation and are slightly bent outwards. In regard to position these processes recall the wartlike prominences carrying a pencil of setæ, which occur near the extreme end of ovipositor in Phalangioidæ, and we believe that like the latter they are tactile organs. In *Parasiro* this branched seta or process is not found, but in its place there are two slender undivided setæ.

In the preliminary notice of Loman's first paper (*Zool. Anz.* III. 1880, pp. 90—92) he announced that he found a pair of receptacula seminis near the end of ovipositor in Phalangioidæ, which discovery was confirmed by de Graaf, Rössler, and Sörensen (*c*). According to de Graaf and Sörensen they are equipped with accessory glands; according to the latter with two glands to each receptaculum, and, in addition, he found them furnished with a muscle. Sörensen (*c*) further found receptacula in a species of Laniatores which he examined for the purpose. In a paper quite recently published Loman (*g*) states that eight receptacula exist generally in Laniatores but two in Triænonychoidæ. That statement, together with the fact that Phalangioidæ are the only family amongst Palpatores in which receptacula have been found, caused us to look for receptacula in representatives of the three other families of Palpatores and in several Laniatores. In Phalangioidæ we did not find anything deviating from what has been hitherto known: the two rather narrow receptacula, each with a more or less developed proximal lobe or branch (Pl. VI., fig. 2), are placed at or close behind the base of forceps. In Troguloidæ and Nemastomatoidæ the receptacula are placed somewhat more posteriorly. In *Trogulus rostratus* Latr. they are short rounded sacs. In *Nemastoma lugubre* O. F. Müll. they are rather large, laterally compressed and irregularly lobate (Pl. VI., fig. 6). In *Ischyropsalis* they are situated far backwards in ovipositor, almost at its posterior end; they are very peculiarly shaped, with four long branches (Pl. VI., fig. 4). Of Laniatores we have examined *Pachyloides uncinatus* W.S. and *Discocyrtus testudineus* Holnb., both of the family Gonyleptoidæ, *Assamia*

(*Maracandus*) *reticulata* E.S. of the family Assamoidæ, and *Pelitnus* sp. of the family Oncopodoidæ. These forms are representatives of main-types of the sub-order Laniatores in the restricted sense proposed by Loman (on the family Triænonychoidæ, the type on which Loman founded his sub-order Insidiatores, we shall speak separately below). In these Laniatores a transverse section of the interior lumen of more than the proximal half of ovipositor is shaped as a star with four long rays; eight receptacula are arranged in a whorl at the front end of the posterior fourth or third of the lumen; they originate near the outer end of the rays named, one receptaculum on each side of the end (Pl. VI., fig. 11). The receptacula are often large oblong or elongate sacs, sometimes smaller and less oblong. It must, however, be added that in *Pachyloides*—but only in that form—we found besides six small receptacula, three on each side between two rays, in advance of the large ones, and the smallest one of these three placed in front of the two others (Pl. VI., fig. 11, *rs*¹). In *Pelitnus* we saw sixteen proportionally small receptacula which at least apparently were independent, but in the two specimens examined the ovipositor was, unfortunately, in a very bad state of preservation (the specimens having been desiccated at an earlier period), and for this reason we have been unable to decide with absolute certainty whether the sixteen receptacula are really separate from each other or whether each pair may be connected as in *Acumontia*. Furthermore we examined ovipositor of *Acumontia echinata* Poc. belonging to the family Triænonychoidæ; it contains eight receptacula in a basal whorl (Pl. VI., fig. 13), but each consists of a larger proximal and a smaller slightly more distal oblong sac, and the very short duct from each of these two sacs opens into a somewhat longer common duct (Pl. VI., fig. 13, *rsd*). This result being quite different from the above-mentioned statement of Loman it was of importance to us to examine another representative of the family in question, and through the courtesy of Prof. K. Kraepelin we had the good fortune to study the ovipositor of *Triænonyx Valdiviensis* W.S. In this form we found eight receptacula shaped as oblong posteriorly widened sacs which are arranged in a sub-basal whorl (Pl. VI., fig. 12) quite as in the majority of the above-named Laniatores. We may add that a muscular layer with transverse fibres surrounds more than the basal half of ovipositor beneath the skin and covers the receptacula (Pl. VI., fig. 12); whilst essentially longitudinal muscles occupy the space between each pair of receptacula on the same side, receptacula thus belonging to two different rays. Finally we may remark that in our study of the receptacula in Palpatores and Laniatores we were not anxious to look for such accessory glands as are known in Phalangioidæ; in order to undertake that investigation a considerably greater material would have been required.

In Cyphophthalmi ovipositor is not thick enough to hinder a person acquainted with receptacula seminis in the other Opiliones from seeing that they are found also here. We have indicated them (in the left blade of forceps) on our figures of the ovipositors which we have examined, viz. those of *Purcellia*, *Siro*, and *Parasiro*. We have not been able in our preparations from specimens preserved in spirit to ascertain their outline with perfect certainty, but we believe that we may venture to say that they resemble mostly those which occur in Phalangioidæ; but whether they are equipped with accessory glands we do not know.

De Graaf has shown (figs. 119 and 120 amongst others) as regards Phalangioidæ, that when at rest ovipositor is enclosed within two chitinous sheaths. We had on examination found the same to be the case in *Nemastoma* and *Trogulus*, and it may therefore be

assumed to be the rule in Palpatores. In Laniatores and Cyphophthalmi, on the contrary, ovipositor has only one single sheath. In Cyphophthalmi the sheath is thin¹ in the greater part of its length, but fairly rigid, so that it does not collapse after being cut open, even if ovipositor is taken out of it. In Laniatores (Pl. VI., fig. 8) the sheath is to a considerable extent covered by a muscular stratum (*ms*) of which the posterior extremity, as in all Opiliones, is fixed to that place where the sheath joins the base of ovipositor; from this place the muscular fibres pass first forwards, but somewhat to the side, then making a rather sharp bend backwards and a little outwards, in order to attach themselves to the inside of the sternite, a little more laterally off the base of ovipositor. In *Trienonyx* we found this structure a little deviating: only a portion of the fibres of the muscular stratum turns backwards from the lateral part of the sheath, while other fibres proceed farther forward on the sheath itself and terminate there. There are besides here a pair of muscles (*mo* in Pl. VI., fig. 8), which attach themselves to the posterior angle of operculum genitale and clearly serve to close it and to keep it closed. The function of this pair of muscles is not principally to close operculum genitale, but to keep it closed, when the animal contracts its segmental muscles for any other purpose than to push out ovipositor or penis, because the same holds good for both organs. When the segmental muscles are in action a pressure is of course exercised on the whole interior of the animal, with all the organs which are found there. What the effect of this pressure will be, depends in each case on which other muscles at the same time contract or not; because if the muscles serving for the evacuation of any organ act at the same time, the evacuation of the contents takes place so much the more quickly; but if the sphincter of the organ acts, the contents are kept back. We may here mention a direct observation made by Sörensen (*b*, p. 182) with regard to Laniatores to the effect that it is possible by means of a gentle pressure on that part of abdomen which consists of separate segments, to cause the liquid to flow out from the odoriferous glands and generally also from the urinary bladders², and that, he says, "all the more easily, when the animal has been killed and the sphincters consequently act only *vi inertiae*. The liquid is almost always evacuated, in greater or smaller quantity, when the point of the knife is pressed against the skin in order to cut open the body, the skin being, as will be remembered, very tough and not at once penetrated by the knife; it is so far indifferent where the knife presses the skin." In another place Sörensen says (*ibid.* p. 203): "When the point of the scalpel is introduced where the ventral surface of abdomen joins the inner border of the last pair of coxae, penis is often suddenly exserted—particularly when at the same time operculum genitale is opened with the point of a needle—and as a rule, not only the whole of penis but with it a portion, about one half, of the sheath is exserted before the knife breaks the skin." But the exsertion of penis or ovipositor with the appertaining sheath must, on account of the rather large bulk of these organs, diminish the pressure exercised on abdomen. It is therefore clear that the muscles which close operculum genitale offer the animal a powerful means of emptying the other organs. The mechanical principle which operates here is evidently the same as we see in mammalia, where the pressure produced by the action of the expiratory muscles on the interior of the thoracic cavity and—indirectly—of the body in general, when epiglottis is closed, is utilized to facilitate the evacuation of urine and excrements.

¹ In *Purcellia* the sheath is more firmly chitinized at its junction with the outer skin in the genital aperture, forming there an obversely hastate plate. We do not know whether

anything similar occurs in the other genera.

² Neither the urinary bladders nor the odoriferous glands are provided with any muscular stratum.

In *Nemastoma* the muscular stratum of the sheath of ovipositor is attached anteriorly to the outer chitinous sheath near the anterior extremity of the latter; in *Phalangioideæ*, for instance in *Acantholophus* (Pl. VI., fig. 1), the middle portion of this muscular stratum (*ms*) both on the upper and on the under side is fixed anteriorly to the sheath itself, whilst the lateral portions anteriorly bend outwards and a little backwards in order to insert themselves on the skin. Both in *Nemastoma* and in *Acantholophus* two pairs of muscles are found in front of this muscular stratum, of which the posterior one, which is represented in the whole of its length on Pl. VI., fig. 1, *md*, rises from the skin in front of the lateral portions just mentioned of the longitudinal muscular stratum of the sheath, and attaches itself to the sheath, the fibres spreading fan-like; most of them, and those the strongest, pass slantingly forwards but a few are even directed a little backwards. The other pair of muscles marked *me* on the same figure, pass on the contrary exclusively obliquely forwards and attach themselves as shown in the figure to a small tendon-like expansion of the sheath a short distance behind the genital orifice.—In *Cyphophthalmi* there is on the outside of the sheath a thin layer of longitudinal muscles of which the fibres run parallel through about the posterior half of the sheath, but afterwards diverge somewhat on the upper as well as on the under surface (Pl. IV., fig. 1 *t*, *ms*), and finally attach themselves to the sides of the sheath. Anteriorly there is a pair of muscles (*md*) passing obliquely forwards from the skin to the sheath.—As in all *Opiliones* there is a further pair of muscles, *mr*, which anteriorly are attached to the posterior extremity of ovipositor, but posteriorly are inserted on the skin.

We have examined a larger number of these animals than our predecessors and found the arrangement of these muscles somewhat different from what had been stated by them, whereby we have been led to a somewhat different view of them from that entertained by earlier writers. We agree with them all in looking upon the pair of muscles which we have marked *mr* as *m. retractores ovipositoris*, and we agree with Sörensen in thinking that the pair of muscles marked *mo* in *Laniatores* serve to close operculum genitale; but we are also of opinion that the pair of muscles which we have marked *me* perform the same function in *Palpatores*, although they do not attach themselves to operculum genitale itself but to the sheath at a point closely behind the genital orifice. It is certain, in any case, that their contraction after ovipositor has been drawn in must have the effect indicated, but it is very possible that this pair of muscles may also serve to expand the sheaths of ovipositor and thus to assist in drawing them back when ovipositor is wholly exserted and the sheaths are entirely turned inside out. It may be mentioned here as a fact which agrees with our view, that no such pair of muscles is found in *Cyphophthalmi*, in which operculum genitale is not movable. We agree with de Graaf¹ in the view that the pair of muscles in *Palpatores* (and *Cyphophthalmi*), which we have marked *md* on our figures, serve to distend the sheaths round ovipositor, when it is about to be exserted or retracted. Concerning the layer of longitudinal muscle-fibres in *Laniatores*, Sörensen expressed the view (*b*, p. 202) that it cooperated with the intersegmental muscles of abdomen in exerting ovipositor, but he had not noticed that a portion of these muscles is bent backwards, as above described—a fact which renders Sörensen's interpretation of these muscles untenable. On account of this backward turn these muscles can only assist in drawing back ovipositor

¹ De Graaf certainly saw both these pairs of muscles, which we have marked *md* and *me* on our figures, but he confused them; *m''* on his fig. 84 is our *md*, but on his figures 85 and 89 *m''* is our *me*.

when it is exserted and the sheath turned inside out, because only in this position of the sexual organs do the muscular fibres run straight. It follows that at any rate in Laniatores the abdominal muscles alone must be capable of causing the exertion of ovipositor. In the case of Phalangioidae de Graaf considers that the stratum of longitudinal muscles serves to draw ovipositor back, and for the reasons stated above in speaking of Laniatores we must adopt this view as far as the lateral portions of the stratum are concerned. But we are not sure that the same function can be attributed to the middle portion of this muscular layer on the dorsal as well as on the ventral side in Phalangioidæ, seeing that this portion is attached anteriorly to the sheath, which fact had escaped de Graaf. We entertain the same doubt with regard to the entire stratum in Nemastomatoidæ and in Cyphophthalmi, because as the muscular fibres are fixed to the sheath with both ends it is even very probable that they may assist both in turning out and in drawing in the sheath at the commencement of these acts.

The accessory glands of the sheath will be treated of below (p. 63, note) in connection with the corresponding glands in the male.

Penis exhibits in shape and structure excellent systematic characters for the sub-orders as well as for the four families of Palpatores. In all Palpatores it consists of two more or less distinct parts, glans (*c*) and corpus penis (*b*). In *Phalangium* and the genera most nearly allied to it, such as *Platybunus* (Pl. VI., figs. 14 and 15) and *Acantholophus*, the junction of glans with corpus penis admits of considerable freedom of movement, as evidenced by the fact that glans when in a state of rest is bent a good deal backwards, so that the ventral surface turns upwards, whilst it is directed forward when penis is exserted. In *Leiobunum*, *Gagrella* and *Sclerosoma* (Pl. VI., figs. 16 and 17) the movability of glans with regard to corpus penis is not so great as in Phalangini nobis, and accordingly glans is directed forwards in these genera when at rest, as has been shown already by de Graaf with regard to the first mentioned genus. In the other three families glans is directed forwards when at rest, or—where the distal portion of corpus penis is arched upwards as in *Ischyropsalis* (Pl. VI., fig. 18)—glans forms in point of direction the continuation of the arch. In *Trogulus* (figs. 26 and 27) the skin is rather thin at the junction between glans and corpus, which must entail a certain freedom of movement between the parts. In *Ischyropsalis* (figs. 18 and 19) and *Nemastoma lugubre* (fig. 21) the movability is very small and in *N. argenteo-lunulatum* (fig. 25) the skin is so thick at the junction that movement seems impossible. Glans is often equipped with spines varying in shape and number¹, which, we think, act as incitamenta during copula. In all Palpatores glans terminates in a produced slender tube, at the extremity of which is the orifice of the continuation of the seminal duct; this tube is bent upwards, towards the dorsal side in Phalangioidæ (Pl. VI., fig. 15), but in the other families it is bent downwards. In *Nemastoma argenteo-lunulatum* where glans is unsymmetrical (Pl. VI., figs. 22 and 25) the tube of it turns downwards, and at the same time to the right. In *Ischyropsalis* we have noticed (Pl. VI., fig. 19) a remarkable feature, viz., that on either side of glans there is a spot of not inconsiderable extent (*w*), where the skin is quite thin so that it looks like a window-pane.

Corpus penis offers not a little variety in Palpatores. In *Trogulus* it is quite straight,

¹ Loman and de Graaf have discovered specific characters in the more minute structural details of penis in the species examined by them. The same is the case with other species

also, but it would be beyond the scope of the present paper to enter more fully on that subject.

in Phalangioidæ it is only slightly curved upwards, in *Ischyropsalis* (Pl. VI., fig. 18) its distal portion is arched upwards rather strongly but gradually, in *Nemastoma* the species differ in this respect. In *N. argenteo-lunulatum* it is arched rather strongly but evenly; whilst in *N. lugubre* (Pl. VI., fig. 20) it is curved strongly and abruptly, in front of its expanded part, but the rest of its distal portion is almost straight. The most peculiar feature of corpus penis in all Palpatores is that it is thicker at its posterior extremity, a shape due to the fact that the posterior portion, which varies as to its proportionate length, contains a muscle, or—in *Nemastomatoidæ* and *Troguloidæ*—a pair of muscles, with the respective tendon or tendons attached to the base of glans on the ventral side. It is the shape of this muscular apparatus that determines the shape of corpus penis, apart from its curvature, which is different in different species. The simplest form of corpus penis is met with in *Troguloidæ* (Pl. VI., fig. 26) where it diminishes in thickness pretty evenly from the base to the end, as the pair of muscles (*mc*) almost reach to the apex of corpus, and is furnished with a pair of short tendons (fig. 27, *tmc*). In this group corpus is covered with thin skin, but in its ventral side there is a long narrow strip, which is more firmly chitinized, commencing near the anterior extremity of corpus and diminishing gradually in width towards the posterior extremity; the chitinized membrane of corpus shows a peculiar marking, consisting of very fine transverse lines. Both these features are also found in *Nemastoma* (Pl. VI., fig. 25) where corpus is firmly chitinized; in *N. lugubre* the wall of corpus must even be described as thick. In Phalangioidæ the posterior, thicker portion of corpus penis, which contains the muscle, is as a rule not sharply separated from the thinner and more slender part. In *Ischyropsalis* (Pl. VI., fig. 18) corpus is similar to the same organ in Phalangioidæ, but the anterior portion is much more slender, and its wall much more firmly chitinized. Penis is of extraordinary length in *Nemastoma*; in *N. lugubre*, where it is longer than in *N. argenteo-lunulatum* it is so long that, when quite drawn back it reaches past the alimentary canal, on the right side of it, beyond anus towards the dorsal surface, in accordance with its sharp curvature, as far as the seventh tergite of abdomen, so that when penis is entirely drawn back, *m. retractores penis* are directed forwards. A peculiarity in *Nemastoma* is that the posterior portion, which here is much thicker, is somewhat flattened, remarkably short and heavy, and thereby sharply separated from the very long and thin distal portion; the tendons of the pair of muscles contained in the thicker portion are accordingly of extreme length. It is scarcely necessary to say that this apparatus serves to erect glans in Phalangioidæ, where it is bent backwards when at rest. In *Sclerosomatini nobis*, *Ischyropsalidoidæ*, *Nemastomatoidæ* and *Troguloidæ*, where glans is directed forwards when at rest, of course no erection can take place, and the muscular apparatus serves probably to stretch glans penis down towards the ventral side as far as possible, acting in a way similar to that of the muscle on the inside of the lower jaw between *os articulare* and *os dentale*, in many fishes, for instance *Cottus* and *Gadus*.

In the great majority of Laniatores (Pl. VI., figs. 29 and 32) penis differs not a little in shape from that organ in Palpatores. Corpus penis is very slender through the whole of its length, the posterior portion not being increased in bulk, as it does not contain any muscles. The posterior extremity of corpus is expanded in the shape of a collar in the place where it joins the surrounding chitinized sheath; it is a little thickened anteriorly where it joins glans. This latter (*c*) is not by any means so abruptly separated from corpus penis as is the case in the great majority of Palpatores, and it consists of

two principal parts (Pl. VI., figs. 30 and 31, 33 and 34), a dorsal and a ventral one. The former (*d*) of these, which contains the continuation of the seminal duct, is rather soft and the end of it is somewhat bent upwards, bearing on its extreme point the opening of the seminal duct, which is generally very small, but proportionately large in Assamoidæ (fig. 34). On the ventral surface of this part processes occur of varying shape and number; in most cases there is, however, only one (fig. 31); in Assamoidæ (that is in *Maracandus*) there are none (fig. 34). The other principal part of glans is a ventral plate (*e*) variously equipped with marginal spines, and which in most species is concave on the dorsal side, so as to embrace to some extent the dorsal main part of glans; in Assamoidæ (figs. 33 and 34) the ventral portion embraces the dorsal one entirely, so that the lateral margins of the former coalesce completely, without so much as a suture remaining to indicate the fact of their having been originally separate. It is no doubt in accordance with this fact, that the ventral plate is more distinctly separate from corpus penis in Assamoidæ than in most other cases; generally the boundary between them is indicated only by a very fine line (fig. 31). In most *Laniatores* the distal end of corpus is somewhat excavated so as to embrace to some extent the dorsal part of glans, which is thus capable of a little passive movement in all directions; the same is the case with the whole of glans in *Maracandus*. In a paper quite recently published Loman states (*g*) that corpus penis in Triænonychoidæ contains a muscle subservient to the erection of glans. We have examined the structure in *Acumontia rostrata* Pock. and found that Loman is right. We think that our figures (Pl. VI., figs. 36 and 37) sufficiently plainly show the shape of the organ; we may only add that the ventral plate (*e*) is deeply cleft in the middle line, a feature not visible on our figures.

In *Cyphophthalmi* the shape of penis is very different from that which we have described as occurring in the two other suborders, as may be seen on our figures (Pl. I., figs. 1*x* and 1*y*; Pl. IV., figs. 1*o*, 1*p* and 1*q*; Pl. V., figs. 1*m*, 1*n* and 2*o*). Whilst in the other sub-orders this organ is elongate, slender and more or less firmly chitinized, it is in *Cyphophthalmi*, on the contrary, short, thick and rather slightly chitinized, the chitine being fairly thick only in the distal fourth or fifth part of its length. Nor can penis well be said to consist of two clearly distinct parts in this group. It is true that the setæ, which are stout and very long, especially when compared with the length of the organ itself, are all placed on its distal portion, and that on this ground it might be allowable to distinguish between two principal parts of penis in this group also; but we do not feel justified in doing so.—The apical portion in *Purcellia* (Pl. IV.) and *Siro* (Pl. V., fig. 1*m*) shows some thicker lines in the integument on the upper surface; in *Purcellia* some similar ones are seen also on the sides, as well as a transverse strip on the under surface.

Our figures of penis in three out of the four genera which we have examined, *Stylocellus* (Pl. I., figs. 1*x* and 1*y*); *Purcellia* (Pl. IV., figs. 1*o*—1*q*) and *Siro* (Pl. V., figs. 1*m* and 1*n*), are, we believe, sufficiently accurate to render detailed descriptions superfluous. The apical extremity of penis is prolonged into a cone which protrudes a little on the ventral side of the opening for the evacuation of semen. This cone is as a rule slightly flattened, but in *Stylocellus* it is much depressed, the apex of it being rounded and emarginate. The proximal portion of penis contains several bundles of muscular fibres, which mostly have a longitudinal course. In *Purcellia* and *Stylocellus* there are besides a couple of bundles of fibres running in a plainly oblique direction. We regret having been unable to decide

whether these muscles belong to the continuation of the seminal duct—which would be quite different from what occurs in the two other sub-orders—or to penis itself. To decide this point would have required a more abundant material for dissection than we had at our disposal, as penis is rather thick.

In all Opiliones penis is surrounded by a single chitinous sheath which for the greater part is very thin. De Graaf has already pointed out the existence in Phalangioidæ of a couple of longitudinal strips which are thicker than the rest of the sheath; these strips are also found and are much stronger in *Ischyropsalis* and particularly in *Nemastoma lugubre*, but we have not found any such in Troguloidæ. It would follow that the strength of these strips of chitine stands in a certain correlation to the thickness of the chitine in corpus penis; their function is probably, by means of their elasticity, to stretch the sheath both when retracted, and, particularly, when exserted. Such strips of thicker chitine are not found either in Laniatores or in Cyphophthalmi.

The muscular equipment of the sheath is different in the three sub-orders of Opiliones and likewise in the different families of Palpatores. Amongst Laniatores we have found it similar in representatives of Gonyleptoidæ, Assamiodæ and Triænonychoidæ—three families which are by no means nearly allied to each other. The sheath is here surrounded by three layers of muscles. The direction of the fibres of the two innermost layers, which are the heaviest, is oblique, in one layer to the right, in the other to the left, so that the fibres cross each other (Pl. VI., fig. 28, *mg*). Posteriorly these muscles are inserted on the collar-like expanded posterior extremity of penis, anteriorly they attach themselves to the sheath somewhat behind the genital orifice; there can consequently be no doubt of the function of these two layers being that of facilitating the exsertion of penis. A third moderately thin (in *Acumontia*) or very thin layer which Sörensen overlooked envelops the other two; its fibres are longitudinal on the lower surface, on the sides and above they are posteriorly essentially longitudinal, but towards the anterior end they are gradually more and more transverse across the sheath; with one end the fibres attach themselves to the sheath posteriorly and along its dorsal side, with the other end they are fixed as two oblong bundles beneath the sheath to the sternite, somewhat or only a little behind the genital orifice. To judge from its attachments this muscular stratum must be capable of contributing both to the exsertion and to the retraction of penis, in the first stages of these acts. Muscles for the expansion of the sheath are not found in Laniatores; but operculum genitale (*o*) is furnished with one pair of muscles (Pl. VI., fig. 28, *mo*) which serve to close it, and particularly to keep it closed when the animal desires to utilize for other purposes the pressure exercised on the interior organs by contraction of the segmental muscles of abdomen. As in all other Opiliones a pair of musculi retractores (*mr*) start from the posterior extremity of penis and pass to the dermoskeleton at a point not far in front of anus.

In all the families of Palpatores the following three sets of muscles are found, viz. one pair of *m. retractores* (Pl. VI., fig. 22, *mr*), a pair of *m. protractores* (*ibid. mp*), both of which have been noticed by earlier writers, and a third pair which has hitherto been overlooked. As de Graaf has already pointed out in Phalangioidæ, *m. protractores* rise from the posterior end of the sheath, pass forwards and a little outwards, and fix themselves to the ventral dermoskeleton outside the sheath and a little in front of its middle.

In Nemastomatoidæ, at any rate in *N. argenteo-lunulatum* (Pl. VI., fig. 22, *mp*), they rise from the dorsal side of the sheath along the greater anterior portion—not from the hindmost portion—of that part which is situated above the thick part of penis containing its muscles, and also from that part of the sheath situated above the posterior portion of the slender part of the penis. The third pair of muscles (Pl. VI., fig. 22, *me*) are inserted on the sheath close to its anterior extremity, and pass from thence backwards, diverging a little, and attach themselves to the dermoskeleton. In our opinion they serve to keep operculum genitale closed. Ischyropsalidoïdæ and Nemastomatoidæ possess besides a fourth set of muscles (Pl. VI., figs. 18 and 22) on the posterior part of the sheath, but their course is not the same in the two families. In *Ischyropsalis* this pair of muscles (fig. 18, *mf*) commence posteriorly on the dorsal side of the sheath, where they meet in the middle line, and pass from thence forwards and downwards, so that they reach much farther forwards on the ventral side than on the dorsal side. In *Nemastoma*, on the contrary, they commence on the posterior part of the ventral side of the sheath (Pl. VI., fig. 23, *mg*) and pass forwards and upwards (*mg* on fig. 22), ending anteriorly a little away from the middle line near the insertion of *m. protractores*. In *Nemastoma*, finally, a fifth pair of muscles are found (Pl. VI., fig. 22, *mh*), of which the anterior extremity is fixed to the sheath immediately in front of the last-mentioned pair of muscles, from which point they pass backwards and a little outwards to the skin. We have therefore no doubt but that this pair of muscles serve to expand the sheath when penis is to be exserted, a view which is confirmed by the fact that this pair of muscles are found only in *Nemastoma*, that is to say in the only genus where penis is rather abruptly divided into two parts of different thickness, and by the circumstance that they are attached to the sheath precisely at the junction of the thicker and the more slender part of penis, as may be seen by comparing fig. 23 (on Pl. VI.) with fig. 22.

In Cyphophthalmi the muscular equipment of penis and its sheath is but little developed. Penis is furnished only with *m. retractores* (Pl. I., fig. 1*v*, *mr*) and the sheath possesses only one pair of muscles (*md*), which pass obliquely outwards from its anterior portion to the integument. It cannot be doubted that they are intended to dilate the sheath, when penis is to be exserted, and it is worth noticing that these muscles occur precisely in this group, where penis is short and blunt. At the time when we examined penis in those few specimens of Cyphophthalmi which could be spared for the purpose of dissection we were not aware that the arrangement of these muscles offers interesting systematic characters; but we nevertheless believe ourselves justified in saying that no other muscles are found here than those we have mentioned.

Large accessory glands opening in the anterior portion of the sheaths of both penis and ovipositor have long ago been noted in Phalangioidæ. In our opinion their secretion serves to facilitate the sliding of these organs forward and backward, for which reason Sörensen (*b*) has called them lubricating glands. The last-named writer found them in *Pachyloides uncinatus* of the family Gonyleptoidæ, but of a different shape from those in Phalangioidæ. From this he concluded that the differences in respect of these glands were of systematic value for the characters of the sub-orders; but that is not the case¹. Of

¹ In *Pachyloides uncinatus* Sörensen (*b*, p. 195, Pl. II., fig. 27) found only one such gland, without lobes and small—only half as long as the diameter of the sheath including its

muscular stratum; in a male of the same species we have however found a pair of glands about twice as long as the diameter of the sheath. In the male of *Discocyrtus testu-*

Cyphophthalmi we have examined three representatives with regard to this point, and in the females of those two forms of which the specimens were in the best state of preservation, *Purcellia* and *Parasiro corsicus*, we found a pair of very peculiar organs which we believe to be the glands in question. They are shown in Pl. IV., fig. 1 *t, g*, which represents ovipositor with its sheath of *Purcellia*. It is a pair of oblong bodies, which lie close to the sheath along the distal quarter of its length. The gland has no general excretory duct, but after the removal of one half of one of these glands we noticed a great number, probably more than one hundred, exceedingly fine tubes which penetrated the walls of the sheath, and entered deeply into the substance of the gland without subdivision. We conclude that each glandular cell has its own excretory duct; but we cannot pronounce a very decided opinion on this question, as the condition of our specimens was not so good as could have been wished for histological examination. In the males we have not found any such glands, but we do not feel justified on that account in denying their existence, particularly as they may possibly be of a different aspect in the male from what we found in the females, as is the case in *Maracandus*.

13. *The External Sexual Characters, particularly in Cyphophthalmi.*

It has long been known that in the majority of Palpatores—in fact in all except Troguloidæ—the sexes may be readily distinguished by external marks, which, however, are of so diversified a nature that no general account can be given of them. The same is the case in most Laniatores. Within the same genus the characters by which the sexes may be distinguished are generally the same, but species of different genera often differ considerably in this respect. At the same time there are genera amongst Laniatores in which the sexual difference is but little pronounced externally. We would therefore draw attention to the fact that operculum genitale offers characters by which it is always possible to distinguish the sexes in both these sub-orders, provided of course that both sexes are represented amongst the specimens at one's disposal. The sexual differences observable in

dineus Holmb. we have also found a pair of glands (Pl. VI., fig. 28, *g*) of about the same length as penis. In the female of *Pachyloides uncinatus* Sörensen found one gland of the same shape as that found in the male, only somewhat smaller; we have not found any such in the specimens which we have examined, but most likely a pair of glands are present. In the female of *Maracandus reticulatus* a pair of very long and slender glands are found, resembling nothing more nearly than a tree with long slender branches, which in their turn ramify. As in the other Laniatores, a rather wide common duct extends longitudinally through the whole gland, into which numerous fine tubes open. In the male of the same species we have found the basal portions of the same two glands in the same place as in the female, but besides these we found on the dorsal side of the sheath, close behind the anterior margin, a transverse belt formed by a very large number, probably many more than a hundred, rather short and, as it seems, not ramified, extremely thin tubes, which open into the sheath. The glandular cells to these tubes are much smaller than those of the other glands. The lubricating glands in Phalangioideæ are the well-known

pair of large glands which the earliest writers, Treviranus, Tulk and Leydig, erroneously interpreted as testes in the males, but of which the glandular nature was discovered by Lubbock and afterwards by Krohn (*a*). They are much smaller in the females than in the males, but are otherwise alike in both sexes. The most detailed account of these glands in this family is given by de Graaf, to whose paper we therefore refer. They open dorsally in the sheath, close to each other, whilst in Laniatores they open quite laterally, close behind the anterior margin of the sheath. They are divided into many lobes; a common duct passes through the middle of each of them and their lobes; no fine tubes, however, open into this duct as is the case in Laniatores, but the glandular cells form in Phalangioideæ an epithelium round the duct. These glands in Phalangioideæ are ramified tubular glands, whilst in Laniatores they are racemous glands. As it did not appear to us that the nature of these glands offered any features of much systematic interest, we have not considered it of sufficient importance to investigate them in Ischyropsalidoidæ, Nemastomatoidæ and Troguloidæ.

operculum genitale are grounded on the difference in shape between penis and ovipositor. From the description of these organs which we have given in the preceding chapter, it will have been gathered that, particularly in Laniatores, Ischyropsalidoidæ, Nemastomatoïdæ, and Troguloidæ, penis is anteriorly much more slender than ovipositor. Accordingly the genital orifice is narrower in the male than in the female, and, as a consequence of this, operculum genitale is narrower and therefore proportionally—in some cases even absolutely—longer in the male than in the female. We may mention, for instance, that by this means the sexes are more or less easily distinguished in Troguloidæ, which has not hitherto been possible; in the male of *Dicranolasma* operculum genitale is almost exactly as long as it is broad, and in its posterior half the lateral borders converge but slightly towards the anterior extremity; but in the female operculum genitale is strikingly broader than it is long, and its lateral margins converge considerably from the base forwards. In the sub-family Trogulini E. S. the difference is more difficult to appreciate; in the male *Trogulus sinuosus* W. S. operculum genitale is four to five times broader than it is long, and the lateral borders are less curved and form a more distinct angle with the anterior border than in the operculum genitale of the female, which besides is about six times broader than it is long.

In Cyphophthalmi the case is different. In this group zoologists have hitherto not been able to distinguish the sexes by external characters. This, however, was only owing to the fact that these animals have hitherto been but imperfectly examined, since it is precisely for them that we find ourselves able to give at least two sexual characters, of which moreover one is highly distinctive, while of both we may venture to say that they hold good for all members of this sub-order, and not only for those which we have examined. The leading character is taken from the shape of the fourth tarsus. In the females this increases in thickness, uniformly but not considerably, from the base to its distal end. In the males, on the contrary, the fourth tarsus carries on its dorsal side, more or less near the base, what we in our descriptive text call "eminentia dorsualis." This may be described as consisting of a basal part and a less stout distal portion, which is flattened and pointed. These parts are of somewhat different shape in different species, and will therefore be treated of in our descriptions of species. That part of the joint where eminentia dorsualis appears is more or less enlarged. This is the case only to a small degree in *Stylocellus*, the one genus which is endowed with eyes; it is much more, and conspicuously, enlarged in all the other genera, in none probably more than in *Purcellia* and in *Siro rubens*; in this latter species the joint (Pl. IV., fig. 2 d) is enlarged on the dorsal side in nearly the whole of its length. This enlargement of the fourth tarsus and its "eminentia dorsualis" in the males are only an external evidence of the much more essential fact that this enlarged part of the joint contains a gland which is absent from the females. As shown in Pl. V., fig. 2 n, the common excretory duct of this gland widens towards the opening which, at any rate in *Purcellia*, *Parasiro*, and *Siro duricorius*¹, has a situation rather distant from the distal extremity of eminentia dorsualis. On account of the conformation of the excretory

¹ We discovered this gland only when we had already returned the specimens of *Pettalus*, which we had borrowed, and when we had already dissected the specimen of *Stylocellus* which we could spare for anatomical research; and the chitine of *Stylocellus* is so thick that it is impossible without dissection to discern the inner organs even in a part as slender as the tarsus. Of *Siro rubens* we have had only

one specimen before us, the only one known to exist in any collection, but without the application of a rather strong magnifying power it is impossible to decide where the opening of the gland is situated. On this point therefore we are unable to give any information as regards *Stylocellus*, *Pettalus* and *Siro rubens*.

duct just indicated, the liquid secretion must flow out slowly and be able to spread over the under surface of the flat distal part of the eminence. Although we have not had any living specimen before us, we feel no doubt as to the use of the secretion of this gland, which is found only in the one sex; it must serve to render the other sex, in this case the female, cognisant of the presence of the former in the neighbourhood, which implies that the secretion must be, or contain, an æthereic oil, which, contrary to the secretion of the odoriferous glands, is probably of a not disagreeable odour¹. This interpretation is corroborated by the fact that, to judge from the shape of the joint, the gland must be less developed in *Stylocellus*, that is to say in those Cyphophthalmi which can see, and thus have one more means of finding the other sex. At the same time the fact that this gland is found also in those species which are endowed with eyes is a further proof of Cyphophthalmi being a type of essentially blind animals.

The other set of external characters to which we alluded as being available for distinguishing the sexes in all the representatives of Cyphophthalmi with which we are acquainted, is taken from the genital orifice, its shape and particularly the distance of its anterior margin from the third pair of coxae. In treating of the dermoskeleton we have already pointed out, as one of the characters of the sub-order Cyphophthalmi, that the genital orifice is an open hole, which is not covered by a *movable* operculum genitale, as is the case in the other sub-orders. The genital orifice offers specific characters, and we have therefore represented it on figures of all the species; from these figures it will be gathered that although an operculum genitale may be said to exist in Cyphophthalmi in a morphological sense, yet functionally there is none. The anterior border of the true second abdominal sternite is prolonged so as to cover more or less the hindmost portion of the genital orifice, and sometimes this prolongation is separated from the rest of the second sternite by a groove or a suture, but, as we have said, it is never movable. In all Cyphophthalmi, hitherto known, the genital orifice is longer in proportion to its width in the female than in the male. But a far more trenchant character is found in the following fact. Arculi genitales are much shorter in front of the genital orifice in the female than in the male, from which it follows that the distance from the anterior margin of the genital orifice to the third pair of coxae is in the female always many times shorter than the genital orifice itself; whilst in the male this distance is at the least nearly equal to the length of the genital orifice, viz. in *Stylocellus*; generally it is longer than, and in *Purcellia* it is even twice as long as, the orifice. The sexes also differ to some extent as to the size of the opening, but this character is less valuable; in *Stylocellus* the area of the genital orifice is not considerably smaller in the male than in the female, but in *Purcellia*, *Siro* and *Parasiro* it is much smaller.

Besides these characters which may be described as not only clearly distinctive in themselves, but applicable to all Cyphophthalmi, there are some others of less general occurrence. In all the genera known to us, excepting *Parasiro*, the following further difference between the sexes in the shape of the genital orifice may be noticed; in the male the ridges on arcui genitales are continued so far forward that they almost reach the anterior border of the genital orifice, or even, as in *Pettalus* and *Purcellia*, a considerable distance beyond it;

¹ To prevent a possible misinterpretation, we observe that there is no possibility of this eminentia with its gland being a kind of weapon. The distal portion of the eminence is too weak to serve such a purpose, particularly in those species in

which the gland is the largest; in several species, moreover, the distal part is bent downwards against the dorsal surface of the joint in a manner which renders the use of the end as a weapon impossible.

but in the female they only reach a proportionately short distance beyond the anterior margin of operculum genitale and at the same time project a little into the genital orifice. The latter accordingly exhibits an outline rather conspicuously different in the two sexes, which may be best described by saying that the genital orifice is a hole which is directed straight downwards in the male, but is upon the whole directed somewhat forward in the female.

In *Purcellia* there is this remarkable sexual difference, that the fourth tarsus is undivided in the female, but is in the male divided into two joints (Pl. IV., fig. 1*m*), of which the basal one contains the gland above described. There are instances of operculum anale exhibiting a peculiar shape in the male; in *Pettalus* and especially in *Purcellia* the entire anal region is extremely different in the two sexes (Pl. IV., figs. 1*i* and 1*k*). We do not know the female of *Pettalus*, but we may nevertheless say with certainty, that the character on which Thorell founded this genus, viz. the remarkable appearance of the posterior extremity of the body, is in reality only one of the sexual characters of the male in this genus.—We may add that also among Cyphophthalmi the sexual characters of the male appear to have systematic value, being peculiar to each genus, as is the case among Laniatores.

14. On *Gibocellum sudeticum* Steck.

In 1875 and 1876 Stecker published two papers in German on a most remarkable animal named by him *Gibocellum sudeticum* and said to have been discovered in the Riesengebirge (Sudeten mountains) in Bohemia, of which papers the first was translated in the *Ann. and Mag. of Nat. Hist.* The second of these papers, which is entitled "Anatomisches und Histologisches über *Gibocellum*," contains a series of descriptions of the anatomical structure of the animal, particularly the more minute anatomy, illustrated by four plates. These papers have several times been referred to in scientific treatises, but, as far as we are aware, none of the authors who have noticed the histological data have had any hesitation in accepting Stecker's statements, though several of these might well provoke criticism. As an instance of such we may translate¹ the following (*b*, 305): "I have removed the cuticular stratum from the matrix and left the latter in the open air under a watch-glass for about 24 hours². During this space of time...the chitinogenous membrane of *Gibocellum* became subject to a very limited process of secretion, the chitinous stratum formed constituting only a very thin covering (of only one-tenth of the thickness of the matrix), consisting of cells which had not yet become distinctly fusiform. The cells are mostly of elliptic shape, though some occur approaching to the fusiform. It is only after 48 hours that the stratum of cells recovers its former state of development, in which its thickness amounts to about two-thirds of the thickness of the matrix below it; at the same time the stratum acquires a brownish colour, which is visibly due to a secretion from the layer of connective tissue." Surely it is a surprising statement that a "cuticular stratum" consists of cells, though it is less wonderful than that a small animal, 2·5 mm. long, which had been treated in the manner above described, should have been in possession of such vitality that a bit of the chitinogenous

¹ For the reader's convenience we have translated our extracts from the second (*b*) of Stecker's papers; our quotations from the first (*a*) are taken from the translation in the *Annals*.

² Stecker's own words are: "Ich habe die Cuticularschicht von der Matrix abgetragen, und dieselbe etwa 24 Stunden unter einem Uhrgläschen in freier Luft liegen lassen." If

Dr. Stecker had not been an Austrian-German, the word "dieselbe," on account of its position in this sentence, could only refer to "die Cuticularschicht." Therefore we point out that it cannot possibly have been Stecker's intention to tell what he did with the removed chitine, but he intended to state how the matrix reconstructed the chitinous cuticula.

membrane removed from the animal produced a "secretion" of a cellular stratum which in 24 hours attained a thickness of one-tenth, and in 48 hours a thickness of two-thirds of the matrix.—The reason why no writer appears to have had any hesitation, from a histological point of view, in accepting the histological statements of Stecker, is probably this: that he professes to have made use of the ordinary reagents for microscopical research. At the same time it may have been a concurrent cause, that Stecker was known as the author of several purely histological papers published during 1876 and 1877 (viz. *Ueber die Entwicklung der Chthonius-Eier im Mutterleibe und die Bildung des Blastoderms*,—*Ueber die Furchung und Keimblätterbildung bei Calyptreæ*,—*Die Anlage der Keimblätter bei den Diplopoden (Chilognathen)*, *Ein Beitrag zur Entwicklungsgeschichte der Myriopoden*).

At the hands of a couple of systematic writers the papers of Stecker on *Gibocellum sudeticum* received much less appreciation. According to his own statements (*a*, pp. 241, 242; *b*, pp. 293—296) his new genus was most nearly related to the Cyphophthalmoids described by other writers, *Cyphophthalmus*, *Pettalus* and *Stylocellus*. Stecker states that he "found himself under the necessity" of erecting the whole of this group into an independent order Cyphophthalmidæ, of which he says (*a*, pp. 240, 241), "I have already several times had occasion in this memoir to show clearly the near relationship of the Cyphophthalmidæ on the one hand with the Phalangiidæ [i.e. the Opiliones], and on the other with Chernetidæ"; nevertheless he placed Phalangiidæ [i.e. Opiliones] and Cyphophthalmidæ together so as to form a higher unity: "Opilionea." At the same time he divided his new order Cyphophthalmidæ into two families: Cyphophthalminæ comprising the three genera already known, viz. *Cyphophthalmus*, *Pettalus* and *Stylocellus*¹, and Gibocellinæ, which only consisted of *Gibocellum*. The difference between the two families was according to his statement, that Gibocellinæ had two pairs of eyes, both placed upon obliquely ascending conical tubercles, two pairs of spiracles, and mamillæ at the base of the abdomen.

That *Gibocellum* must be a very remarkable animal, by its anatomical structure, could not but strike all Arachnologists, but none of them would accept Stecker's new order; all of them excepting Thorell referred *Gibocellum* without hesitation to Opiliones. When the last-named author had studied his first species of *Stylocellus* (and *Siro*) he recognized that there must be a considerable difference between real Sironoidæ (Cyphophthalmoidæ) and *Gibocellum* as described by Stecker. He expresses himself thus: (*c*, p. 33) "non magis recte fecisse mihi quidem videtur Stecker, quem Gibocellum ad eundem ordinem ac Cyphophthalmum sive Sironem retulerit," and with regard to Stecker's having placed *Gibocellum* near both Opiliones and Chelonethi Thorell, who was not by any means blind to the defects of Stecker's papers, considered that *Gibocellum* ought to be referred to Chelonethi, and adduced in support of this view several points of Stecker's description.

Sörensen, in his treatise on the anatomy of Laniatores, had been unwilling to take notice of Stecker's papers on this extraordinary creature; but the fact that Thorell had referred *Gibocellum* to Chelonethi compelled him to do so, and he devoted several pages of his next systematic paper (*d*, pp. 560—567) to a criticism of Stecker's treatises, showing that this writer possessed but little knowledge of either Opiliones or Chelonethi, and that his study of *Gibocellum* must have been very imperfect. With reference to those characters on account of which Thorell had thought that *Gibocellum* ought to be reckoned among Chelonethi,

¹ Stecker (*b*, p. 296) leaves it undecided to which of these two families *Stylocellus* Westw. ought to be referred. It

should therefore be noticed that Westwood had overlooked the real ("sessile") eyes in *S. sumatrana*.

Sörensen remarks: "Quæ, si ill. Thorell dixisset, suis se oculis vidisse, tacuissem. Sed nec Thorell, nec ego hoc animaleulum vidimus. Itaque dico, ill. Thorell errare, non videntem, *Gibbocellum* a doctissimo Stecker descriptum, monstrum esse." And further: "sed de anatomia tota *Gibbocelli* dubitandum est, quod descriptio anatomicæ tota et omnia quæ dicit [Stecker] *Gibbocellum* cum animalibus aliis comparans, fantasiam demonstrat, sed neque facultatem explorandi neque subtilitatem disputandi." Sörensen supported his opinion of Stecker's treatises by a whole series of objections of which we shall here repeat only this, that the diagnosis¹ which Stecker had proposed (*a*, p. 241) for his new order contained only one character, which according to Stecker's own statements constituted a difference between it and Opiliones, viz. that in the new order all the legs were furnished with one claw, whilst according to Stecker's notions his "Phalangiidae," i.e. Opiliones, had one claw only on the legs of the first two pairs, but two claws on those of the last two pairs. To this Sörensen remarked: "Tamen Opilionibus Palpatoribus (velut Opilionibus omnibus Bohemie) singuli pedes gressorii unguibus singulis instructi sunt; et Laniatoribus tantum, quos doctissimus Stecker ceterum cognovisse non videtur, pedes gressorii paris tertii et quarti unguiculis binis instructi sunt." For this and other reasons Sörensen was unable to follow Thorell in removing *Gibbocellum* from Opiliones whilst at the same time he looked upon the various extraordinary statements of Stecker concerning the anatomical structure of *Gibbocellum* as due to a lack of capability for anatomical research in the author.

Four years later Croneberg expressed himself in his treatise on the interior structure of Chelonethi (pp. 458, 459) in words which may be translated as follows: "Though I likewise look upon Sironoidæ as belonging to Opilionidæ, I am, nevertheless, of opinion that Thorell was fully justified in excluding the genus *Gibbocellum* not only from this family, but from the order of Opilionids altogether, and placing it amongst Pseudoscorpions. Sörensen's objection to Thorell's view, viz. that Stecker had erroneously described the maxillary lobe of the first pair of legs, as maxillæ, appears to be unfounded to judge from the figure in question, although I myself have directed attention to the improbability of the representation of the opening of the mouth." But Croneberg had not read Sörensen's paper itself—and without that it is impossible to criticise what an author means—for if he had read it he could scarcely have continued as follows: "But *Gibbocellum* is also the only one amongst the divergent Arachnida lately described, which *really* seems to approach to the Pseudoscorpions...." It is precisely from Croneberg's own investigation of the internal anatomy of Chelonethi that it appears most clearly that there is not the least agreement as regards the inner organs between Chelonethi and *Gibbocellum*, apart from their having two pairs of spiracles, no more in fact than there is in respect of the external structure. It is to be noted that Croneberg had full confidence in Stecker's statements, except as regards the position of the oral orifice in *Gibbocellum* behind the mandibles (maxillæ auctorum) which, however, is not so very different from what is seen in Opiliones.

Thorell, on the contrary, did not consider Sörensen's objections devoid of weight; four years afterwards he wrote (*h*, p. 8, note): "...it is quite possible that that author's [Stecker's] statements are erroneous: conf. Sörensen, *loc. cit.* Before we get a *trustworthy* description of

¹ The entire diagnosis was as follows: "Corpus oblongo-ovatum; cephalothorax cum abdomine coalitus, non divisus, abdomen annulis octo compositum. Antennæ chelatae tribus articulis composite. Palpi duo filiformes, apice unguiculo uno armati. Pedes octo antrorum vel retrorsum gressorii, simplici unguiculo terminati. Oculi in gibbis conicis, ex utroque thoracis latere prominentibus positi. Respiratio trachealis." The three characters which we have printed in *italic* in this diagnosis would exclude *Gibbocellum* from Chelonethi, but not from Opiliones.

that highly interesting animal, it is impossible to decide with certainty as to its true systematic affinities." This observation of Thorell's is unquestionably correct, but a trustworthy description of *Gibocellum* is just what will never see the light.

On account of the great interest attaching to the questions raised by Stecker's description of his *Gibocellum*, both authors of this present paper have several times attempted to obtain a sight of the animal, once on the occasion of a personal visit to the Bohemian National Museum at Prague, at other times by means of written requests addressed to their friends amongst Bohemian zoologists; but all in vain. Mr Joseph Rehák at Prague stated to one of us in letters written in 1898, that the opinion was general amongst Bohemian zoologists, that the animal does not exist, for the following reasons. 1°. The Director of the National Museum, Dr Frič, had in vain offered a large sum for a specimen. 2°. Some Bohemian naturalists, for instance, Mr Babor Schulz, had in all seasons, spring, summer, autumn, and winter, searched for the animal with the greatest energy on the Riesengrund itself (the locality where Stecker stated that he had obtained his twelve specimens) but "of *Gibocellum* no trace." 3°. Nobody in Bohemia had ever seen *Gibocellum*, or any preparations of it, either in Stecker's lifetime or after his death in 1888.

Considering that 80 years elapsed after Latreille's first discovery of *Siro rubens*, before it was found again in France, the two first reasons did not appear to us to carry great weight; and although the third of these reasons certainly was not without importance we would not for a long time look upon the opinion held in Bohemia as justified. But after having finished our studies of Cyphophthalmi, and after having again critically examined Stecker's papers, we cannot otherwise than fully acknowledge the correctness of the view, which is prevalent in Bohemia, to the effect that *Gibocellum* has no existence in reality. Our principal reasons are the following. In considering this question we may proceed on either of two different suppositions.

I. Supposing first that *Gibocellum* really were an animal nearly related to Opiliones; and especially to Cyphophthalmi, as Stecker declares, we would draw attention to four points.

1°. Stecker states that he found in *Gibocellum* the same glands secreting stinking matter which occur in Opiliones ("the cephalothoracic glands of Krohn"), and he devotes nearly four pages (*b.* pp. 333—337) to the description and discussion of them. In the course of this he states that their orifices are situated close to and above the bases of the antennæ (Pl. XVIII., fig. 1); but according to our own investigation it is certain that in Cyphophthalmi the openings of these glands are situated much farther back. Even if we would suppose that this erroneous statement of Stecker might be due to faulty preparation and examination, there are still three points as to which that possibility is quite excluded.

2°. Spines of the kind which, according to Pl. XVIII., figs. 1 and 3, occur on the legs of *Gibocellum*, are not found in Opiliones, least of all in Cyphophthalmi. (Nor, for the matter of that, do they occur in Chelonethi.)

3°. Dr. Stecker did not profess to be able to say much on the subject of the sexual organs, but yet he states (*b.* p. 341): "In the male a fairly long penis comparable to that described by Dr. Joseph (*l.c.*, p. 270) in *Cyphophthalmus*, or the one noticed by Tulk (*l.c.*, p. 250) in *Phalangium*, is seen to protrude from this orifice." The penis being according to this statement exserted in the specimen in question, no preparation of it was necessary, and as it

is an organ with a chitinized surface, it bears perfectly well the pressure of the glass cover without alteration of shape. The organ described by Tulk in *Phalangium* is certainly the penis, but the organ which is seen projecting from the sexual orifice in the *Cyphophthalmus duricorius* Jos., figured by Joseph in fig. 17, is not a penis, as Joseph thought, but the ovipositor of the female, as shown already in 1873 by Sörensen (*a*, p. 509, note 2). This mistake of Joseph has thus been fatal to Stecker, because it is clear from the description of the latter that he cannot have made a mistake analogous to that committed by Joseph. "The penis," he says, "is very long but capable of being drawn back into the body, in which case it shines through the abdominal segments. It...consists of two distinct portions, a corpus and a glans, which exhibit a leathery consistency." Even without the express reference in the note : "See the figure of the penis in *Phalangium*, in the paper of Tulk, *l.c.* Pl. IV., figs. 21—25," the reader will easily perceive that the penis in *Gibocellum* according to Stecker's account agreed in structure entirely with this organ in *Phalangium*. Anyone having any confidence at all in Stecker's statements would look upon the perfect agreement in point of structure between this organ in *Phalangium* and in *Gibocellum*, which Stecker referred to his "order" Cyphophthalmidae, as affording a further proof of a comparatively near relationship between Palpatores (*Phalangium*) and Cyphophthalmi (*Gibocellum*). That Stecker, however, has not seen the penis of any *really existing* Cyphophthalmoid will be clear to anyone who casts a glance on our figures¹ of penis in four *really existing* Cyphophthalmi. In none of them could it be described as "fairly long" or even "very long"; it is on the contrary short or even very short; it cannot well be said to be divided into a corpus and a glans, and it differs in shape altogether from that of *Phalangium*.

4°. Concerning the ovipositor in *Gibocellum* Stecker says (*b*, p. 341): "The ovipositor of the female is also a long organ, which, as in *Phalangium opilio*...is situated under the integuments through which it can be seen as a black line², by means of which the female is easily distinguished from the male." This latter statement is perfectly true of *Phalangium*, but as far as we are aware not of any member of Sironoidae; no one of these possesses a black ovipositor, whilst at the same time the stratum of chitine is too thick to allow of any ovipositor being visible through it.

II. As an alternative we may suppose that Stecker merely erred in looking upon *Gibocellum* as an animal related to Opiliones, but that his statements in themselves are true at least as regards its external appearance; if so, we have to draw attention to the following points:

1°. Stecker states in his earlier treatise that on the dorsal face of the cephalothorax a "roll-like elevation" is seen to extend between the first and the second pair of eyes forming a curve, which elevation in his opinion corresponds to the anterior curved groove (sic !)³ (our "sulcus posterior cephalothoracis") in *Cyphophthalmus duricorius* Jos., and he agrees with Joseph in considering that this marks the boundary between head and thorax, so that that part of the body which intervenes between this curved line and the foremost of the straight transversal grooves (which latter is the boundary between thorax and abdomen) would have to be looked upon "as the pro- meso- and metathorax" (*a*, p. 233). According to this interpretation, the posterior pair of eyes would be situated on the thorax. It seems that

¹ Pl. I., figs. 1x—1y; Pl. IV., figs. 1o—q; Pl. V., figs. 1m, 1n and 2o.

² Italicized by us.

³ In his second paper Stecker maintains the same opinion, and he continues: "Die Erhabenheit bei *Gibocellum* ist also nur als eine Varietät der Querfurchen zu deuten..."

Stecker, before he wrote his second treatise, had learnt that this was not admissible, because, as is universally held, all Condylopoda have the eyes on the first segment of the body. In his second paper therefore Stecker writes (*b*, p. 297): "Against the correctness of such a division the fact might be adduced, as regards our animal, that the elevation takes its rise between the eyes, so that one eye would have to be reckoned to the head, the other to the thorax; I must, however, observe that the elevation certainly seems to take its rise between the eyes; but that it already is found on the ventral side *on which it is slightly turned backwards, after which it appears again on the dorsal surface at the posterior margin of the posterior ocular protuberance.*" But the statement which we have printed in italics implies an absolute impossibility, both in the nature of things and because this "elevation" on the ventral side in that case would have to extend right across the coxae (cf. Pl. XVII., fig. 2). This Stecker has overlooked in his anxiety to cover his former thoughtlessness¹. This utterance may properly be compared with his above-mentioned statement on the reconstruction of the chitinous layer of the skin; that in both cases he has confidently relied on the heedlessness of his readers would be clear to us, even if we had not fully understood how recklessly absurd his statements really were.

2°. In the text he says (*b*, p. 307), "Although the coxae are firmly coalesced with the parts of the thorax...", which implies that the coxae are immovable. Nevertheless the trochanters of the first and second pairs of walking legs (i.e. the third and fourth pairs of limbs) are figured in Pl. XVII., fig. 1, as very distant from each other, whilst in fig. 2 they appear rather close together, so that the second pair of legs are placed much farther back on the animal according to fig. 1 than according to fig. 2. Yet both these figures are described as "ad nat. del." It is clear enough that the difference between the two figures is much too great to be attributable to deficiency in the art of drawing, however considerable.

The foregoing suffices in our opinion to prove that *Gibocellum sudeticum* is altogether a creation of Stecker's fancy; in what follows we shall endeavour to show how it has been built up. As regards the outer shape Stecker's model was no doubt *Cyphophthalmus duricorius* Jos. which, however, he had never seen, and knew only from description. In order to establish a generic difference between that and *Gibocellum*, the latter was equipped with two pairs of stalked eyes, two pairs of spiracles, and with spinning mamillæ. As regards the internal structure we must first remind our readers that at the time when Stecker's papers were published *Phalangium* and a few nearly allied genera of Phalangioidæ were practically the only Opiliones² that had been anatomically examined, so that as regards anatomy a reference to Opiliones was tantamount to a reference to *Phalangium*.

Stecker attributed to *Gibocellum* the nervous system of *Phalangium* with the difference that the two large abdominal trunks are said to be separate from their origin in *Gibocellum*,

¹ There are many other instances of this kind, of which we shall only mention one here. An attentive reader of Stecker's passages concerning *Cyphophthalmus duricorius* Jos. (for instance what he says on p. 309 in (*b*) on the subject of the mouth) cannot fail to recognize that Stecker has never seen this animal. Nevertheless he says (*a*, p. 232), "Whilst in the Scorpions, many Chernetidæ and the genus *Cyphophthalmus*, there is a very thick chitinogenous membrane, and the secretion takes place so rapidly..." But this information

about the chitinogenous membrane in *Cyphophthalmus* is quite new, and implies therefore that Stecker himself examined an animal which as a matter of fact he had never seen.

² The only information, at that time available, on the anatomy of Opiliones outside Phalangioidæ was contained in the memoir which we have cited, by Sir John Lubbock, in which an account is given of the internal sexual organs of *Nemastoma lugubre* O. Fr. Müller.

whilst in *Phalangium* they are united as far as about the end of the fourth pair of coxae, according to Tulk (Pl. V., fig. 33).

Stecker could not know that the supposed eyes in *Cyphophthalmus* really are orifices of odoriferous glands; he therefore ascribes to *Gibocellum* the glands of this kind existing in *Phalangium*, but places their openings, not, as in *Phalangium*, above the ends of the coxae of the first pair of legs, but above the base of the antennæ (chelicerae).

It is also from *Phalangium* that the sexual organs of *Gibocellum* were borrowed, Stecker being unfortunate enough not to discover that what Joseph had figured as the penis of *Cyphophthalmus* was really an ovipositor.

For its respiratory organs *Gibocellum* was indebted partly to *Phalangium*, partly to Chelonethi. The tracheæ which take their origin from the first pair of spiracles are (according to Pl. XVIII., figs. 2 and 3; Pl. XX., fig. 4) supplied with spiral thickening as in *Phalangium* and (b, p. 339) are even more ramified than in the latter. The course of the main trunks resembles to a certain extent Tulk's figure of those in *Phalangium* (Pl. IV., fig. 33); but the two tracheal trunks are represented as united into a single trunk for a considerable distance, whereby *Gibocellum* would differ not only from *Phalangium* but also, we should think, from all other Condylopoda—a point which Stecker has not noticed. According to his description *Gibocellum* would agree with Chelonethi not only in having two pairs of spiracles, but more especially because the tracheæ, said to start from the posterior pair of spiracles in *Gibocellum*, exhibit the same arrangement as those with the same starting-point in certain Chelonethi. The arrangement, be it understood, is that which Stecker imagined these tracheæ in Chelonethi to present, viz. 1°, that the tracheæ in question are neither ramified nor furnished with spiral thickening; and 2°, that they have no common trunk, each of them taking rise¹ from an opening in the spiracle which is perforated like a sieve (b, pp. 338, 339). The first of these alleged peculiarities in *Gibocellum* would imply that this animal possessed tracheæ of two different types², which would be a unique case amongst Arachnida; the second peculiarity implies a morphological impossibility unless a great number of spiracles were collected into a small space—a feature which would be without a parallel amongst Condylopoda.

Tulk had misinterpreted a portion of the Malpighian tubes as salivary glands (p. 429; Pl. IV., fig. 18), and accordingly Stecker endows *Gibocellum* with a pair of tubiform salivary glands (b, Pl. XIX., h).

These complete the list of the organs transferred from *Phalangium* to *Gibocellum*. Besides these, Stecker furnished *Gibocellum* with spinning organs, the position of which, according to Stecker's opinion (b, p. 328), agreed with what he (at any rate when he wrote that particular page) believed to be the case in Chelonethi. The fact is that Menge (p. 14) had come to the result that Chelonethi possessed spinning glands, of which the spinnerets were near the anterior extremity of the abdomen, either in front of the sexual orifice (in *Chelifer*, *Cheiridium* and *Chernes*), or behind it (in *Obisium* and *Chthonius*)³. Stecker having

¹ Or in Stecker's own words, “To each little tube corresponds an opening in the closing valve, which is perforated like a sieve.”

² With regard to this point we refer our readers to the considerations on the two different types of tracheæ in Arachnida, which will be found below in our description of

Ricinulei.

³ According to Croneberg (p. 455) the indications of Menge were erroneous, the glands in question being in reality accessory to the sexual organs. It may be added that later on it was proved by Bertkau and Croneberg that the spinning-glands of the Chelonethi in reality open on the antennæ.

placed the sexual orifice of *Gibocellum* close to the base of the abdomen, could of course not locate the four spinning mamillæ in front of it, but placed them behind the orifice, and in a depression, as also should be the case in *Obisium* and *Chthonius*. At the same time he seems to have been doubtful as to where best to place the mamillæ in *Gibocellum*, because according to the text (*b*, pp. 294 and 328) they were to be found on the second abdominal sternite¹, but according to Pl. XX., fig. 1, their place was on the first sternite. The external form and structure of the mamillæ, as well as of the spinning glands, he stated to agree with those parts in Araneæ.

A very striking feature—according to Stecker’s own showing—in the composition of *Gibocellum* is the intestinal canal, which is very remarkable for an Arachnidan: it is said not to be furnished with cœca (*b*, p. 323) “as in the Araneæ, *Galeodes*, etc.” but it exhibits irregular expansions which “thus are to be looked on as a homologue of the cœca possessed by other spiders” (*b*, p. 324). Besides this the intestinal canal is sinuate (*b*, p. 325). That is not the case in any other Arachnidan, a circumstance which, however, the author does not mention.

Still more remarkable are the Malpighian tubes which Stecker himself describes as “peculiarly developed” (*b*, p. 328), because, says he, “at about the middle of their course they are subdivided into numerous narrow small tubes, which, however, again unite by degrees into larger and larger tubes, until at last they reappear as simple canals forming loops.” The representation of this portion of the Malpighian tubes on Pl. XIX. looks more like the capillary network in a vertebrate than any organ known to us in any Condylopozan. In *Phalangium* the Malpighian tubes were recognized as such for the first time by Plateau, whose treatise only appeared in 1876, that is in the same year as Stecker’s second paper on *Gibocellum*.

It was, as already stated, from *Siro (Cyphophthalmus)* that Stecker borrowed the external features of his *Gibocellum*, the number of abdominal segments, the structure of the limbs and the eyes, though in this last matter he was not very careful. On Joseph’s figure of *Cyphophthalmus duricorius* Jos. the organs which he mistook for eyes are quite correctly placed above the interspace between the second and the third pairs of legs; but in Stecker’s second paper, the first pair of eyes are placed a little in front of the first pair of legs, whilst the second pair are seen a little behind the same. Although the posterior pair of eyes in *Gibocellum* are thus placed considerably further forward than the so-called eyes in *Cyphophthalmus*, the position of the eyes relatively to the above-mentioned “roll-like elevation” shows that it is the posterior pair of eyes that have been acquired for *Gibocellum*.

Joseph’s account of the structure of the mouth in *Cyphophthalmus duricorius* was neither good nor very intelligible, and therefore Stecker could not understand it (*a*, p. 236; *b*, pp. 308, 309). Accordingly he “decided” not to sacrifice any of his twelve specimens to an examination of the mouth of *Gibocellum*, “because,” says he, “I was chiefly anxious to obtain a clear idea of the internal anatomy.” This much, however, was clear enough from Joseph’s account, that in *Cyphophthalmus* the basal joints of the palpigerous limbs have the oral orifice between and behind them, and accordingly Stecker tells us that (*b*, Pl. XVII., fig. 2) the mouth in *Gibocellum* is situated behind the basal joints of the palpigerous limbs.

¹ At the same time Stecker says in another place (p. 300): “An orifice between the second and the third abdominal segments appears to me to correspond to the spinning orifice observed by me in Chelonethi.”

Joseph had committed the insignificant error, in examining his first specimen of *Siro (Cyphophthalmus) duricorius*, of believing that he saw a small pointed hook ("Häckchen") on either side of the point of the palpus. This led to the equipping of *Gibocellum* with a thick blunt hook ("Häckchen") at the point of the palpus; whereby the latter, which is figured in b, Pl. XVII., fig. 5, is made to look not a little like the terminal part of the palpus in *Cryptostemma*.

It is not to be denied that Croneberg is right in a certain sense—though not in the sense intended by him—when he concludes his paper on the anatomy of Chelonethi with these words: "But *Gibbocellum* is also the only one amongst the divergent Arachnidans lately described, which seems really to approach to the Pseudoscorpions, and it is probably to be derived from them, not vice versa; it seems to have only a superficial¹ similarity to the Sironoidæ." But we believe that we have shown that *Gibocellum* is to a still larger extent "derived" from Opiliones (*Siro* and *Phalangium*).

We confess that we do not highly value phantasy in Natural Science; but in the estimation of those who consider it great praise, in writing of a naturalist, to extol "that combination of knowledge and phantasy which was among the prominent gifts of our investigator," as we read not long ago in an obituary sketch, Stecker's treatises must occupy a very high rank, because they give evidence both of much reading and of creative phantasy. As, however, *Gibocellum sudeticum* Stecker has no claim to a place in the System of Nature, we have thought it to be in the interest of Science to remove it, and it is in order to prevent its reappearance that we have devoted more space to it than it might otherwise deserve.

C. SYSTEMATIC PART.

In the preceding part of our paper we have treated of the anatomical structure of Cyphophthalmi with constant reference to that of the two other sub-orders of Opiliones, such as we have found the latter to be by our own investigations or by reliance in a very few cases on the statements of others. Our readers, we venture to think, will agree that Cyphophthalmi offer characters so important, and at the same time so distinctive, that the group is fully entitled to rank as an independent sub-order of Opiliones. It is indeed so entirely distinct, that we are unable to decide to which of the two other sub-orders it approaches more nearly. We trust that the full characterizations of the three sub-orders, which we are about to offer, will clearly show their peculiarities. We propose also to give the characters of the families of Palpatores, because we assume that students of these animals will appreciate a collected statement of such alterations in the characters as our investigations have shown to be necessary. In this place we shall only point out that amongst the four families of Palpatores, Phalangioidæ is the one which deviates most from the common type, at any rate in the structure of the mouth and the body generally. We are so much the more inclined to emphasize this, because authors of zoological manuals, for instance, in their account of the order Opiliones, are accustomed to give a characterization of the family Phalangioidæ as if these latter animals were the type general. But this mode of proceeding rests on no better foundation than that the authors in question are usually acquainted only with certain species of large size, most common in Europe, which, as it happens, all belong to that family.

¹ The italics are ours.

We may add with regard to Phalangioidæ, that the sub-families Sclerosomatini E. S. and Gagrellini Thor. cannot be maintained. If Phalangioidæ are to be distributed into sub-families, only two such can be established, viz. Sclerosomatini nobis, comprising both the groups just mentioned together with *Leiobunum*, while the other, Phalangiini nobis, must comprise all the other genera of the family. The distinguishing characters of these two sub-families will accordingly be given in the conspectus, after those of Phalangioidæ.

Quite recently Pocock (*d*) attempted to show that Palpatores ought to be divided into two groups: Eupagosterni, comprising Nemastomidæ, Trogulidæ and his new family Dicranolasmidæ, and Apagosterni, comprising Ischyropsalidæ and Phalangiidæ. The incorrectness of this view may, in our opinion, be seen from our diagnoses of the families of Palpatores, in which characterizations we have taken into account a much higher number of structural features than that considered by Pocock. Of course, no significance can be ascribed to the characters which in his opinion are found in sternum, because he has misunderstood that part (compare our note 3 on p. 19), and the same must be said of some characters alleged by him which have long been known to be incorrect. It may also have influenced his conception that of Ischyropsalidoidæ he was only acquainted with the genus *Ischyropsalis*, the labium of which differs much as to shape and dimension from those of the other genera of the family.

All authors, viz. Sörensen (*a*), Thorell (*a*), Simon (*b*), and Sörensen (*d*), who in one way or another have expressed the opinion that Ischyropsalidoidæ (or *Ischyropsalis*) are more nearly related to Nemastomatoidæ and Troguloidæ than to Phalangioidæ, have besides clearly shown that of these three types they considered *Ischyropsalis* to stand the nearest to Phalangioidæ. They arranged the four families in the following order: Phalangioidæ, Ischyropsalidoidæ, Nemastomatoidæ and Troguloidæ—and within the last-named family they placed first those genera which by Simon are referred to his sub-family Dicranolasmatini, by Pocock to his family Dicranolasmidæ, next those genera referred by Simon to his sub-family Trogulini, by Pocock to his family Trogulidæ. We emphasize this fact, *inter alia*, because Pocock seems to have overlooked it, as he arranges his families in a not very natural order, viz. Nemastomidæ, Dicranolasmidæ, Trogulidæ, Ischyropsalidæ and Phalangiidæ. But to this the following must be added. Excepting the peculiar position of lobi maxillares coxarum II paris in *Ischyropsalis* already pointed out by Sörensen in his first treatise (*a*) in 1874, all the differences between Phalangioidæ and Ischyropsalidoidæ mentioned by Pocock in his characterizations of the families are certainly features in which these two families differ from each other, but they are *besides* features in which the whole family Ischyropsalidoidæ agree with Nemastomatoidæ and Troguloidæ. It is true that Pocock would still have been able to point out an agreement between *Ischyropsalis* and Phalangioidæ, if he had discovered the diminutive claw on the palpus in *Ischyropsalis*. But as to this feature all genera of the family Ischyropsalidoidæ do not even agree with each other, the claw being quite absent in a couple of genera, while it is rudimentary in the others. When all genera of Ischyropsalidoidæ are taken into account, it must be said that the family as a whole shows itself more closely related to Nemastomatoidæ and Troguloidæ than to Phalangioidæ. When the separate genera are considered the genus *Ischyropsalis* must be said to be on the whole less distinct from Phalangioidæ than is the case with the other genera: but, on the other side, a glance at our characters of the genera conveys the conception that as to one character *Ischyropsalis* itself,

as to another character some other genus, is more distant from Phalangoidæ than the other genera are. The fact is that we are not acquainted with any other family in which the genera present differences from each other so great as in Ischyropsalidoidæ; we have therefore given the characters for each of these genera, having had the good fortune to examine all but one of them. We may add that we have discussed much between ourselves whether it would be proper to divide Ischyropsalidoidæ into a couple of families, but after a prolonged consideration we arrived at the conviction that it would not be justified, *inter alia* because it proved impossible to lay down the separating line in any place without violating natural relationship. Perhaps some zoologist might in the future think of establishing nearly every genus as the type of a family, but for just the same reasons we should dissuade everyone from that attempt.

After the printing of the present paper had begun we received from Professor F. Dahl a treatise on a metamorphosis in the Troguloidæ; the author urges that the genus *Amopaum* W. S. is an immature stage of animals belonging to the genus *Dicranolasma* W. S., and *Metopocea* Simon a juvenile form of *Trogulus* Latr. We consider this to be correct, seeing that the rather few specimens of *Amopaum* and *Metopocea* in the possession of our Museum are immature animals. But we feel bound to add that Dahl has, on the other hand, scarcely been fortunate in his synonymy for the species of *Trogulus*, which, as must be admitted, are exceedingly difficult animals to deal with. *Trogulus sinuosus* W. S., which according to Dahl is the third juvenile stage of *T. nepæformis* Scop. (*T. rostratus* Latr.), was in reality established on animals arrived at sexual maturity. Furthermore *T. albicerus* W. S.¹ is too large an animal to be the first juvenile stage of *T. nepæformis*; from a statement of Simon (*b*, p. 303) on the structure of the "chaperon" in "very young" specimens of *Trogulus* we infer that Dahl probably did not possess such forms.

Loman (*g*) has divided the Laniatores into two sub-orders: Insidiatores, established on the family Triænonychoidæ, and Laniatores, comprising all remaining families. Above we proved that one of his characters, viz. the existence of only two receptacula in Insidiatores but eight in Laniatores, must be cancelled as incorrect. Only two features worth mentioning remain, separating Insidiatores from Laniatores, namely, that in the former group penis contains a muscle to the glans, while that muscle is absent in Laniatores (also in Oncopodoidæ ?), and the number of claws, the main character on which the family Triænonychoidæ was originally based. But in presence of the great conformity between the last-named family and the other Laniatores these two differences together are, in our opinion, far from being important enough to justify the establishment of the Triænonychoidæ as a separate (fourth) sub-order of Opiliones.

¹ Originally this species was established because it possesses only one joint in each tarsus. We have again examined this structural feature; there is no distinct and not even any indistinct articulation of the tarsus.

TERMINI ET RATIO MENSURAS QUASDAM SUMENDI.

Antennas par primum membrorum appellamus, quod vulgo "mandibulæ" nominatur.—Articulus primus in Cyphophthalmis tuberculis inferioribus duobus plerumque instructus est, quorum "basale" lateri inferiori, basin prope, et "exterius" margini exteriori impositum est.—Articulum primum a margine anteriore cephalothoracis metimur, secundum a basi usque ad articulationem articuli tertii.

Arculos genitales segmentum ventrale primum appellamus, aperturam genitalem ante et lateraliter limitans.

Carina dorsualis cephalothoracis Cyphophthalmorum est carina anterior lata, rotundata, in triangulum supra basin antennarum positum plerumque dilatata.

Conos fætidos Cyphophthalmorum conos appellamus, scuto dorsuali impositos, supra intervallum inter coxas II et III jacentes, quibus orificia glandularum fœtidarum ("glandularum Krohnii") imposita sunt. Quos conos auctores superiores "oculos pedunculatos" nominavere.

Coronam analem eam constellationem partium regionis analis appellamus, quae in Op. Palpatoribus adest, in Nemastomatoidis et Troguloidis (inspicias figg. G et H, p. 22) insignis. Corona partibus quattuor formata est: una dorsuali (operculo anali), una ventrali (segmentis ventralibus octavo et—si adest—nono), duabus lateralibus (portionibus segmenti dorsualis noni).

Excavationes anteriores laterales, in Cyphophthalmis, extra carinam dorsualem cephalothoracis positæ sunt.

Mandibulas par secundum membrorum appellamus, quod vulgo "maxillæ" nominatur.

Procurvum arcum, pone convexum, appellamus.

Recurrum arcum, ante convexum, appellamus.

Segmenta ventralia abdominis sic enumeramus: *primum* arculis genitalibus effectum; *secundum* spiracula et operculum genitale gerens, sulco, apud Cyphophthalmos in medio plerumque evanido, a *tertio* limitatum.

Segmentum thoracicum, in Cyphophthalmis unicum conspicuum, posterius, aream appellamus, pone sulcum procurvum cephalothoracis jacentem. In Palpatoribus segmenta thoracica plerumque ambo conspicua.

Stomotheca est excavatio coxarum I, partes oris (exceptis lobis maxillaribus coxarum II) continens.—"Carinæ stomothecæ" (g, Tab. I, fig. 1*l*) sunt carinæ coxarum I, stomothecam lateraliter limitantes.—*Longitudinem* stomothecæ a limite posteriore stomothecæ ad angulum anteriorem carinarum stomothecæ metimur.

Sulcus posterior cephalothoracis Cyphophthalmorum est linea impressa procurva, segmentum thoracicum (posterior) ante limitans.

Ordo: OPILIONES Sund.

1833. Opiliones Sundevall ('Conspectus Arachnidum', p. 34).

Cephalothorax et abdomen latissime conjuncta.

Oculi ad summum et plerumque duo, interdum nulli.

Abdomen segmentis decem compositum. Operculum anale est segmentum dorsuale segmenti decimi, cuius segmentum ventrale deletum est. Segmentum dorsuale nonum et segmentum ventrale nonum sœpe et interdum quidem ventrale octavum deleta. Segmentum ventrale primum ("arculi genitales") saltem ante aperturam genitalem manifestum. Segmenta ventralia saltem secundum et tertium inter se coalita.

Antennæ triarticulatae. Articulus primus longe prominens, saltem aliquanto longior quam latior; articuli primus et secundus angulum subrectum vel acutum quidem formant. Articuli secundus et tertius forcipem verum efficiunt.

Mandibulæ liberæ, minores, deorsum et introrsum vergentes, labrum bipartitum ambeantes, cavitatem oris ante et in parte laterali anteriore claudentes; pars terminalis e cute sat molli vel omnino molli constat.

Palpi mandibulares non chelati, partibus sequentibus formati: trochanterica, femorali, patellari, tibiali et indivisa tarsali; ungue plerumque instructi.

Coxæ I lobo maxillari, ad basin duro in apice molli instructæ, cavitatem oris in parte laterali posteriore et pone partim vel omnino claudente.

Coxæ II lobo maxillari, toto duro, plerumque instructæ.

Labium sternale plerumque adest, lobis maxillaribus coxarum I saltem ad basin conjunctum.

Sternum parvum aut minutum, inter coxas II vel inter coxas II et III situm, cum parte media arcuorum genitalium interdum confluens; rarissime omnino evanidum.

Pedes gressorii trochanterem et patellam liberam habent. Trochanter verticaliter et femur horizontaliter moventur.

Systema respiratorium tracheale, magnopere ramosum; tracheæ spira undique instructæ.

Spiracula abdominalia duo, ad segmentum ventrale secundum pertinentia, aut detecta et ipsi segmento imposita aut obiecta et in sulco saepe profundo inter coxas IV et abdomen sita.

(In familia unica præterea tibiæ pedum gressoriorum spiraculis binis instructæ.)

Canalis digestivus paribus quattuor diverticulorum (simplicium aut ramosorum) præditus.

Tubuli urinarii in rectum canalis digestivi aperientes desunt. Par tubulorum urinariorum simplicium adsunt, in vesicas duas aperientes, quorum orificia aut in margine dorsuali cephalothoracis aut inter coxas III et IV aut ad coxas III posita sunt.

Glandulae fœtidæ duæ adsunt, quorum orificia aut in margine dorsuali aut in dorso cephalothoracis posita sunt.

Systema generationis constat e teste (aut ovario) unico, cuius vasa deferentia (aut tubæ) in vesiculam seminalem (aut oviductum, in "uterum" dilatum) unicam aperiunt. Penis (aut ovipositor) vagina cinctus, e qua protrudi potest et in quam musculis retractoribus duobus retrahitur. Vagina glandulis unguentariis duabus prædicta.—Ovipositor receptacula seminis, numero varia, continet. Apex ovipositoris in linea media fissus, setis, regulariter sed modo vario dispositis, ornatus.

"Organa lyriformia" saltem dorso et ventri abdominis, antennis, coxis I, trochanteribus et femoribus pedum gressoriorum imposta.

Animalia ovipara. Metamorphosis parva aut pâne nulla.

Hic ordo subordines tres, inter se sat distantes, continet.

Subordo I: OP. PALPATORES Thor.

1833. Phalangides et Trogulides Sundevall ('Consp. Arachnid.', p. 35).

1839. Opilionides et Trogulides C. L. Koch ('Uebers. d. Arachnidensyst.', Fasc. 2, pp. 7 and 22).

1873. Opilionides W. S. ('Naturhist. Tidsskr.', R. 3 Bd. VIII., p. 514).

1876. Palpatores Thorell ('Ann. d. Mus. civ. di Genova', T. VIII., p. 462).

1879. Plagiostethi E. Simon ('Arachnides de France', T. VII., p. 157).

Oculi tuberi communis plerumque impositi, nunquam late disjuncti.

Orificia glandularum fœtidarum, tuberi nunquam imposta, supra coxas I prope marginem lateralem cephalothoracis posita.

Orificia vesicularum urinariarum inter coxas III et IV posita.

Palpi graciles, palpantes, ungue parvo aut pusillo aut nullo instructi.

Pars dura lobi maxillaris coxarum I in partes citeriorem et ulteriorem divisa.

Lobus maxillaris coxarum II aut longus et mobilis aut brevis et fere immobilis aut nullus.

Labium sternale adest, ex parte durius, saltem circiter ad medium cum lobis maxillaribus coxarum I cute molli conjunctum.

Sternum brevissimum aut breve, ad summum vix longius quam latius.

Coxæ aut omnes immobiles et inter se coalitæ, aut mobiles.

Pedes I breviores quam II. Tarsi in eundo aut latere inferiore toto aut parte ulteriore lateris inferioris solum contingunt.

Unguiculi pedum omnium singuli, inter se similes.

Segmenta abdominalia dorsalia, præter operculum anale, octo aut novem; nonum, si adest, partes laterales coronæ analis efficit.

Segmenta abdominalia ventralia secundum—septimum magna; posteriora reliqua aut parva, partem ventralem coronæ analis efficientia, aut plane obsoleta.

Apertura genitalis operculo genitali mobili, aut magno aut parvo, clausa.

Penis longus vel longissimus, gracilis. Glans manifesto discreta, multis partibus brevior quam corpus, in processum apicalem gracilem, cuius apici orificium vasis deferentis impositum est, producta, musculo vel pare musculorum, corpore penis contento, movetur aut tenditur. Vagina musculis protractoribus duobus prædicta, et anterioribus duobus qui operculum genitale claudunt.

Ovipositor longus aut sat longus, aut annulatus aut totus mollis, vagina duplice cincta. Vagina strato musculari, et musculis duobus vaginam dilatantibus, et musculis anterioribus duobus operculum genitale claudentibus, prædicta.

Receptacula seminis duo.

Glandulae unguentariae vaginæ tubulares, ramosi (in Phalangioidis tantum perquisitæ).

Differentia sexualis plerumque parva.

Metamorphosis mentionis haud digna. (De spiraculis tibiarum Phalangioidarum vide infra.)

Hic subordo in tribus duas dividendus est.

Tribus A: Eupnoi.

1873. Opilionini genuini W. S. ('Naturhist. Tidsskr.', R. 3 Bd. VIII., p. 515).

1876. Phalangioidæ Thor. ('Ann. d. Mus. civ. di Genova', T. VIII., p. 463).

Antennarum forceps dentibus robustis, obtusis, piceis vel nigris, solum armatus.

Palporum pars tarsalis parte tibiali insigniter longior; unguis insignis.

Lobi maxillaris coxae I partes duræ subæque longæ; ulterior subæque longa atque lata.

Lobi maxillares coxarum II insignes, longi, permobiles.

Labium sternale circiter usque ad medium cum lobis maxillaribus coxarum I conjunctum.

Sternum transversum lamina anteriore libera arcuorum genitalium fere totum obtectum.

Spiracula abdominalia hiantia.

Spiracula accessoria bina tibiis omnibus pedum gressoriorum imposita sunt. In animalibus juvenilibus hæc spiracula nondum aperta.

Arculi genitales juxta operculum genitale conspicui, ante operculum genitale lamina libere prominente instructi.

Operculum genitale permagnum, haud procul ante sulcum transversum, segmenta secundum et tertium limitantem, incipiens.

Ovipositor longus, per longitudinem fere totam manifestissime annulatus; annuli fere omnes setis, in ordinem transversalem dispositis, ornati. Apex profunde fissus annulis tribus formatus; annulus apicalis uterque tuberculo lateralí, setas sensitivas gerente, prædictus.

Hæc tribus familiam unicam continet.

Familia 1: PHALANGIOIDÆ.

1833. Phalangides Sundevall ('Consp. Arachnid.', p. 35).

1839. Opilionides C. L. Koch max. part. ('Uebers. d. Arachnidensyst.', Fasc. 2, p. 22).

1876. Phalangioidæ Thor. ('Ann. d. Mus. civ. di Genova', T. VIII., p. 463).

1879. Phalangiidæ E. Simon ('Arachnides de France', T. VII., p. 158).

1884. Phalangioidæ W. S. ('Naturhist. Tidsskr.', R. 3 Bd. XIV., p. 578).

Oculi tuberi communi impositi; tuber a margine anteriore corporis remotum, mox ante limitem capitidis (sulcum transversum priorem—si adest—cephalothoracis) positum.

Orificia glandularum fœtidarum extrorsum aut oblique sursum vergentia, plerumque detecta.
Spiracula (abdominalia) obtecta.

Lobi maxillaris coxae I pars dura citerior mobilis.

Labium sternale magnum, a sterno non discretum.

Arculi genitales a sterno stria transversa cutis mollis separati.

Coronæ analis vestigia aut adsunt aut plane desunt.

Coxæ omnes mobiles. Calcanei desunt.

Penis subrectus, musculum unicum continet.

Receptacula seminis inæqualiter bilobata, pone apicem fissum ovipositoris posita.

Genera numerosa hujus familiæ in subfamilias duas distribuenda sunt:

Subfamilia 1: Phalangiini.

Phalangiinæ Simon (excepto Liobuno) ('Arachn. de France', T. VII., pp. 158 et 172).

Forceps antennarum dentibus, forma et magnitudine dissimilibus, armatus. (Hac in re Prosalia L. Koch discrepat.)

Unguis palporum mandibularium inermis, aut—rarissime, in genere Gyæ Simon—prope basin tantum pectinatus.

Orificia glandularum fœtidarum magna, detecta.

Coxæ processibus lateralibus destituta.

Corona analis plane deest.

Glans penis (in situ) reclinata.

Sceletus cutis corporis submollis.

Subfamilia 2: Sclerosomatini.

Sclerosomatinae E. Simon ('Arachn. de France', T. VII. p. 158) + Liobunum C. L. Koch + Gagrellini Thorell ('Ann. Mus. civ. di Genova', Ser. 2, T. X., p. 678).

Forceps antennarum dentibus ejusdem formæ et magnitudine subæqualibus per longitudinem fere totam armatus.

Unguis palporum mandibularium pectinatus.

Orificia glandularum fœtidarum parva, interdum (in generibus Sclerosomatis Luc., Astrobumi Thor., Mastobumi E. S.) coxa I obtecta.

Coxæ processibus aut processiculis aut dentibus, lateralibus instructæ.

Coronæ analis vestigia adsunt.

Glans penis (in situ) porrecta.

Sceletus cutis corporis plus minusve durus aut coriaceus.

Tribus B: Dyspnoi.

1873. Trogulini W. S. ('Naturhist. Tidsskr.', 3. R., Bd. VIII., p. 515).

1876. Nemastomoidæ Thor. ('Ann. Mus. civ. di Genova', T. VIII., p. 466).

Antennarum forceps saltem ex parte dentibus gracilibus, longe triangulis, acutis, flavescentibus, subdiaphanis armatus.

Palporum pars tarsalis parte tibiali brevior¹; unguis rudimentarius aut nullus.

Lobi maxillaris coxae I partes duræ, citerior perbrevis et ulterior multo latior quam longior.

¹ In Anelasmococephalo oblongo W. S. differentia sane exigua est: pars tarsalis tantum $\frac{1}{2}$ brevior est quam pars tibialis.

Lobus maxillaris coxae II aut parvus, brevis, fere immobilis, aut nullus.
 Labium sternale lobis maxillaribus coxarum I longe ultra medium vel ad apicem quidem conjunctum.
 Spiracula abdominalia cancellata.
 Spiracula accessoria pedibus desunt.
 Arculi genitales juxta operculum genitale non conspicui, ante operculum genitale lamina libera destituti.
 Operculum genitale parvum, longe ante sulcum transversum, segmenta secundum et tertium limitantem, oriens.
 Ovipositor brevior; trunus non annulatus; apex breviter fissus solus annulos leves, ad summum duos continens, tuberculis lateralibus (setas sensitivas gerentibus) destitutus.

Hæc tribus familias tres continent.

Familia 2: ISCHYROPSALIDOIDÆ.

1872. Nemastomidae p. p. Simon ('Ann. Soc. ent. de France', Sér. 5, T. II., p. 226).
 1879. Ischyropsalidæ Simon ('Arachn. de France', T. VII., p. 265).
 1884. Ischyropsaloidæ W. S. ('Naturhist. Tidsskr.', 3. R., Bd. XIV., p. 577).

Oculi tuberi communi impositi, in parte media aut submedia capitis positi.
 Antennarum forceps per aciei saltem medianam partem dentibus gracilibus, acutis, subdiaphanis armatus.
 Orificia glandularum foetidarum parva, pene extrorsum vergentia, detecta.
 Spiracula detecta.
 Palpi aut ungue rudimentario, in apice rotundato, instructi aut ungue destituti.
 Lobi maxillaris coxae I pars dura citerior nunc mobilis, nunc immobilis.
 Lobus maxillaris coxae II parvus aut exiguis, pronus parum mobilis, aut deest.
 Labium sternale, parte apicali brevi excepta, cum lobis maxillaribus coxarum I conjunctum.
 Scutum cephalothoracale segmentum thoracicum posterius, nunc durum nunc molle, non continet.
 Segmenta abdominalia priora nunc scutum formant, nunc non.
 Coronæ analis vestigia adsunt. (Pars ventralis coronæ interdum, ut in Taraco et Sabaco, magna.)
 Coxæ inter se optime definitæ, alte convexæ, processibus lateralibus destitutæ; aut omnes mobiles, aut omnes immobiles.
 Metatarsis calcanei desunt.
 Penis longus, pone rectus, ante sursum curvatus; glans lateraliter fenestrata, sursum valde curvata, parte apicali setacea (ut in omnibus Dyspnois) deorsum flexa, musculo unico tenditur. Vagina penis præter musculos dictos musculis complanatis posterioribus duobus vestita.
 Ovipositor brevior, in parte apicali tantum setis præditus; articuli apicis fissi haud conspicui. Receptacula seminis prope basin ovipositoris posita, profunde ramosa.—Receptacula in genere Ischyropsalidis solo perquisita¹.

¹ Quod genera omnia præter unum cognovimus, characteres generum dare debere credimus:

Ischyropsalis C. L. Koch.

1839. *Ischyropsalis* C. L. Koch ('Uebers. d. Arachnidensyst.', Fasc. 2, p. 23).

Antennæ longæ, corpore multo longiores. Forceps per aciei citeriorem dimidiā partem dentibus robustis obtusis nigris et per partem medianam dentibus gracilibus, acutissimis, subdiaphanis armatus.

Palpi longi, corpore multo longiores, graciles, ungue pusillo (difficili visu) instructi, pilis simplicibus parce vestiti. Pars femoralis saltem duplo longior quam pars patellaris; pars tibialis plus quam dimidio longior quam pars patellaris; partes patellaris et tarsalis, recta et cylindrica, subæque longæ.

Labrum latum, elevatione anteriore levi rotundata (neque cornu) præditum.

Lobi maxillaris coxae I pars dura citerior immobilis.

Lobus maxillaris coxae II conicus.

Labium latum; pars basalis dura cum sterno duro confluens. Sternum a parte anteriore transversa arcuorum genitalium cute molli manifesta disjunctum.

Orificia glandularum foetidarum suæ laminæ discretæ ("epimere" Simon) imposita.

Segmenta thoracia prima et secundum (liberum) eminentiis, insigniter majoribus quam ceteris, non instructa.

Coxæ immobiles.

Taracus Simon.

1879. *Taracus* E. S. ('Compt. rend. soc. ent. Belg.', Sér. 2, No. 64).

Antennæ longæ, corpore nonnihil longiores. Forceps per aciei citeriorem tertiam partem dentibus robustis obtusis nigris, et per partem medianam dentibus gracilibus, acutissimis subdiaphanis armatus.

Familia 3: NEMASTOMATOIDÆ.

1872. Nemastomidae p. p. Simon ('Ann. Soc. ent. de France', Sér. 5, T. II., p. 226).
 1879. Nemastomatidae Simon ('Arachnides de France', T. VII., p. 277).
 1884. Nemastomoidæ W. S. ('Naturhist. Tidsskr.', 3. R., T. XIV., p. 517).

Oculi tuberi communi, areis anterioribus liberis subcontiguo, impositi.

Antennarum forceps a basi, per aciei majorem partem, dentibus gracilibus, acutis, subdiaphanis armatus.

Palpi corpore aliquanto longiores, ungue pusillo (difficili visu) instructi, pilis simplicibus vestiti. Pars femoralis parte tertia longior quam pars patellaris; pars tibialis vix longior quam pars patellaris; pars patellaris parte tarsali recta fusiformi plus quam duplo longior.

Labrum latum, elevatione anteriore levi, rotundata (neque cornu) præditum.

Lobi maxillaris coxae I pars dura citerior mobilis.

Lobus maxillaris coxae II perbrevis, fere globuliformis.

Labium angustum, rotundatum, a sterno submolli discretum. Sternum a parte anteriore transversa arcuorum genitalium discretum.

Orificia glandularum fœtidarum laminis discretis non imposita.

Segmenta thoracica primum processiculo uno præditum, secundum (liberum) eminentiis destitutum.

Coxæ mobiles.

Tomicomerus Pav.

1899. Tomicomerus P. Pavesi ('Estr. Rendic. R. Instit. Lomb. sci. e lett.', (2) T. 32).
 1899. Tomicomerus P. Pavesi ('Boll. sci. Maggi', Ann. 21, No. 2, p. 57).

Antennæ corpore multo breviores. Forceps a basi, per aciei majorem partem, dentibus gracilibus, acutis, subdiaphanis armatus. (Articulus secundus in mare T. bispinosi supra conice productus.)

Palpi corpore vix longiores, ungue pusillo (pallido, difficillimo visu, plus quam dimidio longiore quam pilis vicinis) instructi, pilis simplicibus, in partibus tibiali et tarsali densius, vestiti. Pars tibialis parte femorali paullulo longior, parte patellaris manifesto longior, pars tarsali fusiformi, extorsum et deorsum leviter curvata, circiter duplo longior.

Labrum cornutum.

Lobi maxillaris coxae I pars dura citerior mobilis.

Lobus maxillaris coxae II perbrevis, fere globuliformis.

Labium angustum, a sterno submolli discretum.

Sternum et arcu genitales confluentia.

Orificia glandularum fœtidarum laminis discretis non imposita.

Segmenta thoracica primum eminentiis insignibus destitutum, secundum (liberum) durum præter ordinem granorum aculeis erectis, sat longis, duobus præditum.

Coxæ mobiles. (Femora et tibiae omnium pedum spurie articulata.)

Sabacon Simon.

1879. Sabacon E. S. ('Arachn. de France', T. VII., p. 266, Tab. XXIV., Figg. 5).

Antennæ corpore multo breviores. Forceps a basi, per aciei majorem partem, dentibus gracilibus acutis, subdiaphanis armatus.

Palpi corpore paullo longiores, ungue destituti; partes femoralis et patellaris parcius, tibialis et tarsalis dense crinibus vestitæ, quorum multi plumosi et pauci quasi annulati. Pars patellaris parte femorali paullulo longior

et manifesto crassior. Pars tibialis parte patellari dimidio longior et manifesto crassior et parte tarsali fusiformi duplo et dimidio longior et vix dimidio crassior. Pars tibialis ad apicem versus sursum curvata et supra (vix intra) excavata; excavatio, partem tarsalem adductam excipiens, glabra.

Labrum cornutum.

Lobi maxillaris coxae I pars dura citerior mobilis.

Lobus maxillaris coxae II deest.

Labium angustum, a sterno submolli discretum.

Sternum et arcu genitales confluentia.

Orificia glandularum fœtidarum laminis discretis non imposita.

Segmenta thoracica primum ordine denticulorum, secundum (liberum) molle præter ordinem denticulorum aculeis erectis duobus instructa.

Coxæ mobiles.

Parasabacon n. g.

1878. Nemastoma crassipalpe L. Koch ('K. Svenska Vetensk. Akad. Handl. N. F.', T. XVI., No 5, p. 111, Tab. III., Fig. 19).

Antennæ corpore multo breviores. Forceps a basi, per aciei majorem partem, dentibus gracilibus, acutis, subdiaphanis armatus.

Palpi corpore paullo longiores, ungue destituti; partes femoralis et patellaris parcius, tibialis et tarsalis dense crinibus vestiti, quorum multi plumosi et pauci quasi annulati. Pars patellaris parte femorali paullulo longior et manifesto crassior; pars tibialis parte patellari paullulo longior et manifesto crassior et parte tarsali fusiformi vix duplo longior et plus quam dimidio crassior. Pars tibialis sursum non curvata, ad apicem interiore 'excavata'; fundus excavationis glabra, partem tarsalem adductam excipiens, regula dura præditus.

Labrum cornutum.

Lobi maxillaris coxae I pars dura citerior mobilis.

Lobus maxillaris coxae II deest.

Labium angustum, a sterno submolli discretum.

Sternum et arcu genitales confluentia.

Orificia glandularum fœtidarum laminis discretis non imposita.

Segmentum thoracicum secundum (liberum) molle aculeis erectis duobus instructum.

Coxæ mobiles.

Phlegmacera Pack.

1884. Phlegmacera cavicolens Packard ('Amer. Natur.', T. XVIII., p. 203).

1886. Phlegmacera cavicolens Packard ('Mem. nation. Acad. Sci.', Washington, T. IV., p. 54).

Genus nobis incognitum. Packard (l.c. p. 54) dicit: "It appears to belong to Simon's subfamilia Phalangiinæ, but has no very close affinities to any of the European genera." E figuris (Tab. XIV., Figg. 5) nihil minus elucet, hoc genus generibus Tomicomeri et Sabaci et Parasabaci affine esse.

¹ Palpus alter deerat; palpus alter evulsus erat. Ad similitudinem Sabaci supponimus, interius articuli latus excavatum esse.

Orifia glandularum fœtidarum deorsum vergentia, obtecta.
 Spiracula obtecta.
 Palpi ungue destituti.
 Lobi maxillaris coxæ I pars dura citerior immobilis.
 Lobus maxillaris coxæ II plane deest.
 Labium sternale parvum, a sterno optime discretum, usque ad ipsum apicem cum lobis maxillaribus coxarum I conjunctum.
 Sternum et arculi genitales in laminam confluentia, cuius pars anterior, inter coxas I posita, subquadra est.
 Cephalothorax et segmenta dorsalia priora (5) abdominis in scutum coalita.
 Corona analis insignis.
 Coxæ immobiles, inter se optime definitæ, alte convexæ, processibus lateralibus instructæ. Calcanei metatarsis desunt.
 Penis longissimus, pone valde incrassatus, musculos duos continet. Vagina præter musculos dictos musculis duobus dilatatoribus posterioribus, adversus limitem anteriorem partis incrassatae penis positis instructa et musculis complanatis posterioribus duobus vestita.
 Receptacula seminis breviter lobata.

Familia 4: TROGULOIDÆ.

- 1833. Trogulides Sundevall ('Conspectus Arachnidum', p. 35).
- 1839. Trogulides C. L. Koch ('Uebers. d. Arachnidensyst.', Fasc. 2, p. 7).
- 1872. Trogulidæ p. p. E. Simon ('Ann. Soc. ent. de France', Sér. 5, T. II., p. 239).
- 1879. Trogulidæ E. Simon ('Arachn. de France', T. VII., p. 289).
- 1884. Troguloidæ W. S. ('Naturhist. Tidsskr.', 3. R., Bd. XIV., p. 577).

Oculi ad marginem anteriorem cephalothoracis siti, aut tuberi communi (in Trogulinis) aut suo processu (in Dicranolasmatinis) impositi.
 Antennarum forceps a basi per aciem pæne totam dentibus gracilibus, acutissimis, subdiaphanis armatus.
 Orifia glandularum fœtidarum deorsum vergentia, obtecta.
 Spiracula aut obtecta aut detecta.
 Palpi ungue destituti.
 Lobi maxillaris coxæ I pars dura citerior immobilis.
 Lobus maxillaris coxæ II perpusillus.
 Labium sternale minutum, a sterno optime discretum, usque ad ipsum apicem cum lobis maxillaribus coxarum I conjunctum.
 Sternum et arculi genitales confluentia, laminam longe triangulam, inter omnes coxas positam, efficientia.
 Cephalothorax et segmenta dorsalia priora (5) abdominis in scutum coalita.
 Corona analis insignis.
 Coxæ immobiles, inter se minus bene definitæ, leviter convexæ, processibus lateralibus destitutæ. Metatarsi calcaneis instructi.
 Penis longus; corpus rectum, musculos duos continens.
 Receptacula seminis simplicia, sacciformia.
 Animalia juniora generum nonnullorum structura tuberis oculiferi insignia.

Subordo II: OP. LANIATORES Thor.

1833. Gonoleptides Sundevall ('Consp. Arachn.', p. 34).
 1839. Gonyleptides et Cosmetides C. L. Koch ('Uebers. d. Arachnidensyst.', Fasc. 2, pp. 8 and 19).
 1873. Gonyleptides W. S. ('Naturhist. Tidsskr.', 3. R., Bd. VIII., p. 512).
 1876. Laniatores Thorell ('Ann. Mus. civ. di Genova', T. VIII., p. 469).
 1879. Mecostethi E. Simon ('Ann. Soc. ent. de Belgique').
 1879. Mecostethi E. Simon ('Arachn. de France', T. VII., p. 147).
 1884. Laniatores W. S. ('Naturhist. Tidsskr.', 3. R., Bd. XIV.).

Oculi aut tuberi communi impositi aut sat late disjuncti.

Orificia glandularum fœtidarum tuberi nunquam imposta, supra marginem anteriorem coxarum II, in margine laterali cephalothoracis aut ad eum posita.

Orificia vesicularum urinariarum post orificia glandularum fœtidarum, prope marginem cephalothoracis posita.

Palpi robusti; pars tarsalis ungue valido, acuto, prehensili instructa.

Lobus maxillaris coxae I per se immobilis, motu coxae movetur; pars dura lobi non partita.

Lobus maxillaris coxae II semper adest, immobilis, aut nodiformis, rudimentarius, aut ut laminula angusta porrecta formatus.

Labium sternale manifestum, molle; solum ad ipsam basin cum lobis maxillaribus coxarum I conjunctum.

Sternum longum, perangustum, pone raro (in *Triænonychoidis*) dilatatum.

Coxæ I mobilis, ceteræ immobiles, coalitæ.

Pedes I breviores quam II. Tarsi in eundo aut latere inferiore toto aut parte ulteriore lateris inferioris solum contingunt.

Unguiculi I et II singuli; III et IV plerumque bini, raro (in *Triænonychoidis*) singuli. Unguiculi I et II a III et IV structura differentes.

Cephalothorax limitibus segmentalibus destitutus.

Segmenta dorsalia abdominis, præter operculum anale, octo. Saltem priora quinque cum cephalothorace in scutum coalita.

Segmenta ventralia novem. Saltem octavum et nonum coalita; raro (in *Oncopodoidis*) segmenta omnia coalita.

Apertura genitalis operculo genitali mobili parvo clausa.

Penis plerumque longus, gracilis, musculos non continens; in *Triænonychoidis* brevior et crassior, musculum continens, qui glandem movet. Glans semper manifesta, multis partibus brevior quam corpus, in partes duas divisa, quarum superior gracilis orificio vasis deferentis fert, et inferior laminam. Vagina vestita est stratis muscularibus internis duobus, quorum fibrae obliquæ inter se secant, et externo tenui præcipue longitudinali. Ipsum operculum genitale musculus duobus clauditur.

Ovipositor brevis, sat mollis, non annulatus; apex fissus non discretus, corona setarum incurvarum ornatus. Vagina simplex, musculis complanatis duobus instructa. Ipsum operculum genitale musculis duobus clauditur.

Receptacula seminis in coronam subbasalem disposita, octo, quibus interdum nonnulla anteposita sunt.

Glandulæ unguentariae vaginae penis et ovipositoris acinosæ.

Differentia sexualis plerumque maxima, modo vario (secundum genera) demonstratur.

Metamorphosis in *Oncopodoidis* haud memoriae digna. Ceteris in familiis tarsi pullorum omnes biarticulati; tarsi animalium adolescentium I et II biarticulati, III et IV tripartiti; animalium adultorum in articulos numero variabiles divisi. *Triænonychoidis* (et *Oncopodoidis*) exceptis tarsi III et IV pullorum et animalium adolescentium pseudonychio et arolio instructi sunt (quæ organa in animalibus adultis semper desunt)¹.

¹ His de rebus inspiciantur: Sörensen (b, Tab. I. Figg. 9 et 10) et Opil. Laniatores (Chilenses) in: Hamburger Magalhaensische Sammelreise 1902, pp. 3 et 7.

Subordo III: OP. CYPHOPHTHALMI E. Sim.

1879. Op. Cyphophthalmi E. S. ('Arach. de France', T. VII., p. 142).

1882. Op. Anepignathi Thorell ('Ann. Mus. civ. di Genova', T. XVIII., p. 22).

1884. Op. Palpatores p. p. W. S. ('Naturhist. Tidsskr.', 3. R., Bd. XIV., p. 575).

Oculi ("sessiles" auctorum) plerumque desunt. Si (in genere Stylocelli) adsunt, latissime disjuncti sunt, prope suum quisque marginem lateralem cephalothoracis positi.

Orificia glandularum fœtidarum ("oculi pedunculati" auctorum) supra intervallum, inter coxas II et III positum, sita, apici sui quidque tuberis subconici imposita.

Orificia vesicularum urinariarum ad basin interiorem coxarum III verisimiliter posita.

Palpi graciles, palpantes, ungue pusillo, in apice late rotundato, instructi.

Lobus maxillaris coxae I per se immobilis sed motu coxae parum mobilis; pars dura lobi non partita.

Lobus maxillaris coxae II manifestus, aut immobilis aut motu coxae minime mobilis.

Labium sternale deest.

Sternum aut minutum, triangulum, aut nullum.

Coxæ I mobilis, III et IV semper immobiles interque sese coalitæ; II aut mobilis aut coxae III coalita.

Pedes I longiores quam II sunt; II, III, IV apice tantum tarsi in eundo solum contingunt. Metatarsi et tarsi inter se paullulum flexibles.

Unguiculi singuli omnibus pedibus adsunt.

Segmenta dorsalia abdominis (præter operculum anale) novem, omnia insignia.

Segmenta ventralia novem.

Apertura genitalis patet, operculo non clausa. Operculum genitale immobile, parvum, interdum obscurum.

Penis brevis, crassus; glans non discreta, circiter æque longa atque corpus, ante rotundata, setis robustis longis ornata; fibras musculares in diversas partes tendentes, continet, quarum usus incognitus est. Vagina musculis duobus anterioribus dilatatoribus prædicta, sed musculis protractoribus destituta.

Ovipositor longus, per totam longitudinem annulatus; annuli pæne omnes ordinibus transversis singulis setarum ornati; apex fissus annulo unico formatus. Vagina musculis duobus anterioribus dilatatoribus prædicta et strato musculari vestita.

Receptacula seminis duo ad apicem ovipositoris reperisse putamus.

Glandulae unguentariae quodam modo acinosæ.

Differentia sexualis constans tarso IV et situ aperture genitalis demonstratur: tarso IV eminentia dorsualis, canalem glandulæ continens, in mare adest, in femina deest; apertura genitalis maris saltem vix longior et plerumque brevior, feminæ autem aliquoties longior quam spatium aperiatur et coxas III separans.

Metamorphosis parva: animalia juniora latiora et pallidiora sunt; in junioribus segmenta abdominalia posteriora, et dorsalia et ventralia, libera; et dorsalia nonnulla per longitudinem divisa sunt.

Animalia hujus subordinis adhuc cognita inter se tantopere affinia sunt, ut eidem familiæ attribuenda sint.

Familia: SIRONOIDÆ.

- 1839. Sironides C. L. Koch ('Uebers. d. Arachnidensyst.', Fasc. 2, p. 7).
- 1868. Cyphophthalmidae G. Joseph ('Berlin. Ent. Zeitschr.', Bd. XII., p. 249).
- 1872. Trogulidae p. p. E. Simon ('Ann. Soc. ent. de France', Sér. 5, T. II., p. 239).
- 1874. Cyphophthalmidae Westwood ('Thesaurus Ent. Oxoniensis', p. 200).
- 1875. Cyphophthalmidae Cambridge ('Ann. Nat. Hist.', Ser. 4, vol. XVI., p. 388).
- 1876. Cyphophthalmidae Thorell ('Ann. Mus. civ. di Genova', T. VIII., p. 468).
- 1879. Sironidae E. Simon ('Arachnides de France', T. VII., p. 143).
- 1882. Sironoidea Thorell ('Ann. Mus. civ. di Genova', T. XVIII., p. 23).
- 1884. Sironoidea W. S. ('Naturhist. Tidsskr.', 3. R., Bd. XIV., p. 576).

Cephalothorax et segmenta dorsalia abdominis priora octo in scutum dorsuale coalita; segmentum dorsuale nonum liberum. Segmenta ventralia quartum et quintum et sextum secum cumque segmentis secundo et tertio coalita; segmentum ventrale septimum liberum; octavum et nonum coalita.

Spiracula cancellata.

Tarsi (excepto tarso IV maris adulti Purcelliae bipartito) articulis singulis formati.

Hæc familia in duas tribus, notis cuiusdam momenti insignes, satis apte dividenda est.

Subfamilia I: Stylocellini.

Coxæ I mobilis, II et III et IV inter se coalitæ, immobiles.

Carinæ stomothecam limitantes subrectæ; parietes stomothecæ verticales, valde angusti, a latere inferiore inspecti non manifesti; itaque stomotheca præter mandibulas et partes molles loborum maxillarium coxarum I nihil prebet.

Lobi maxillares coxarum II laminas longiores quam latiores, obliquas efficiunt, cum carinis, in parte posteriore marginis interioris coxarum positis, angulum permagnum (130° — 150°) formantes.

Sternum minutum, durum.

Antennarum articulus secundus ordine interiore setarum distantium ornatus.

(De genere *Miopsalidis* Thor., nobis incognito, ill. Thorell dicit: "a *Stylocello* vix nisi defectu oculorum sessilium...discrepat" et: "Stomotheca et partes oris fere ut in *Stylocello* conformatæ videntur." Ob has causas *Miopsalis* ad hanc tribum sine dubio referenda est.)

Conspectus generum Stylocellinorum.

- a. Antennarum articulus primus ad sumnum vix ultra triplo et dimidio longior quam ad basin latior, ad apicem articuli femoralis palporum non attingens. Ratio longitudinis tarsi et metatarsi in omnibus pedibus eadem est:
 - a. Pars femoralis palporum subteres, multo longior quam pars trochanterica. Segmentum ventrale nonum a ventrali octavo bene definitum; segmentum dorsuale nonum ubique liberum. Unguis I pæne duplo brevior quam IV. Oculi (duo) adsunt 1. *Stylocellus* Westwood.
 - b. Pars femoralis palporum admodum compressa, vix dimidio longior quam crassior, parte trochanterica vix longior. Segmentum ventrale nonum cum octavo omnino confluens; segmentum dorsuale nonum cum segmentis ventralibus postremis duobus omnino confluens. Ungues pedum omnium longitudine æquales. Oculi desunt 3. *Ogovia* n. g.
- b. Antennarum articulus primus (teste ill. Thorell) "multis partibus longior quam latior basi, usque ad medium partis patellaris palporum circiter pertinens." Tarsi (teste ill. Thorell) "posteriorres metatarso $2\frac{1}{2}$ —3plo longiores, anteriores metatarso fere 4plo longiores." Oculi ("sessiles") desunt (2. *Miopsalis* Thor.)

Subfamilia II: Sironini.

Coxæ I et II mobiles, III et IV inter se coalitæ, immobiles.

Carinae stomothecam manifesto arcuatæ; parietes laterales stomothecæ aut minus lati et oblique descendentes aut lati, vel latissimi quidem, et per longitudinem excavati; stomotheca itaque, præter mandibulas et partes molles loborum maxillarium coxarum I, aream duram, majorem vel maximam quidem, præbet.

Lobi maxillares coxarum II laminas latiores quam longiores, fere aut omnino transversas, efficiunt, cum carinis, in parte posteriore marginis interioris coxarum positis, angulum fere rectum formantes, aut totam partem basalem (sive interiorem) coxæ occupantes.

Sternum aut minutum, membranaceum, aut nullum.

Antennarum articulus secundus seta interiore unica præditus.

Conspectus generum Sironinorum.

- a. Coni fœtidi a margine laterali cephalothoracis spatio remoti, quod diametro coni multo majus est. Stomotheca sat angusta; ad summum pæne dimidio longior quam intervallum, inter limitem anteriorem (sive angulum anteriorem carinæ) stomothecæ et angulum distalem anteriorem coxæ I positum; coxæ I sese pone in medio non contingunt, quare partes molles loborum maxillarium coxarum I lobos maxillares coxarum II attingunt:
 - 1. Pars trochanterica palporum infra inermis. Tarsus I infra valde incrassatus; solearna insignis, partem ulteriorem minorem articuli explens 4. *Pettalus* Thor.
 - 2. Pars trochanterica palporum processicolo inferiore armata. Tarsus I infra paullum incrassatus, solearna vera autem destitutus 5. *Purcellia* n. g.
- b. Coni fœtidi margini laterali cephalothoracis subcontigui vel ab hoc margine ad summum spatio remoti, quod diametrum coni non superat. Stomotheca latissima; saltem pæne triplo longior quam intervallum, inter limitem anteriorem (sive angulum anteriorem carinæ) stomothecæ et angulum distalem anteriorem coxæ I positum; coxæ I pone in medio contiguæ, quare partes molles posteriores loborum maxillarium coxarum I lobos maxillares coxarum II non attingunt:
 - 1. Metatarsi plus quam duplo breviores quam tarsi. Unguiculi omnes simplices (inermes) 6. *Siro* Latr.
 - 2. Metatarsi paullo breviores quam tarsi. Unguiculi omnes dentibus 2 vel 3 armati 7. *Parasiro* n. g.

Subfamilia I: Stylocellini.

1. STYLOCCELLUS Westw.

- 1874. *Stylocellus* Westwood ('Thesaurus Ent. Oxoniensis', p. 200).
- 1882. *Leptopsalis* Thorell ('Ann. Mus. civ. d. stor. nat. d. Genova', vol. xviii., p. 23).
- 1890. *Stylocellus* Thorell (*Ibid.*, Ser. 2, vol. x., p. 106).
- 1897. *Stylocellus* Pocock ('Ann. Nat. Hist.', Ser. 6, vol. xix., p. 290).

Cephalothorax ante supra basin antennarum in limbum collarem libratum productus, qui basin antennarum usque ad carinam dorsualement transversam anguste amplectitur, quare carina dicta marginem anteriorem cephalothoracis tangit vel eodem fere absconditur. Pars anterior cephalothoracis carinam medium, rotundatam, plerumque latam, per longitudinem ductam, ostendit, in triangulum anteriorem supra basin antennarum desinentem, quum extra carinam cephalothorax ante manifesto excavatus sit.

Segmentum ventrale septimum per totam latitudinem a ventrali sexto bene definitum; dorsuale nonum ubique liberum, vix majus quam ventrale septimum.

Oculi (duo) sessiles, latissime disjuncti, haud procul ante conos fœtidos positi.

Coni fœtidi longiores, a margine laterali corporis spatio remoti, quod (si maximum est) diametrum oculi non superat, extrorsum directi, librati; nodulus orbicularis parti apicali latiori plus minusve rotundatae impositus esse videtur.

Antennarum articulus primus ad apicem articuli femoralis palporum non attingens, ad summum vix ultra triplo longior quam ad basin latior, valde compressus, secundum partem ulteriore marginum inferiorum angulatus, tuberculis inferioribus duobus sat magnis instructus; tuberculum exterius carina laterali cum carina dorsuali transversa conjunctum; basale exteriore majus. Dentes utriusque rami forcipis inter se subsimiles, sat humiles, in ramo mobili minores quam in ramo fixo.

Palporum pars trochanterica inermis, parte femorali paullo crassior et multo brevior; pars femoralis vix compressa; pars tarsalis tibiali brevior.

Coxæ I ante vix productæ; spatium inter angulum anteriorem coxæ et angulum manifestum anteroren carinæ stomotheçæ positum circiter dimidio suo brevius quam carina. Stomotheça longe triangula, angusta, saltem fere dimidio longior quam ante latior. Pars mollis lobi maxillaris in partes tres divisa.

Coxa I latior quam II et III, aliquanto—ad summum quartæ parte—angustior quam IV.

Metatarsi omnes circiter triplo breviores quam tarsi.

Solea tarsi I, pilis brevissimis æqualibus erectis formata, insignis a parte ceteriore tarsi plus minusve manifesto limitata, partem ulteriore majorem excipit.

Tarsi I et II (neque III neque IV) per longitudinem plus quam dimidiam supra manifesto sulcati.

Unguiculi inermes; IV pæne duplo longior quam I.

Differentia sexualis eminentia dorsuali tarsi IV et forma et positione aperturæ genitalis solum demonstratur.

Species adhuc cognitæ, maiores vel mediocres, insularum Indiae orientalis indigenæ.

Conspectus specierum.

S. Javano Thor. omisso, hoc in conspectu species adhuc cognitæ omnes commemoratae sunt.
S. Javanus Thor. prope *S. Weberii* verosimiliter collocandus est.

A. Dorsum corporis (excavatione lateralí anteriore sæpius excepta) densissime granulatum:

I. Antennarum pars ceterior articuli secundi non ultra medium (sæpe ad basin tantum) granulata. Sulcus thoracicus posterior manifestus:

a. Pars posterior cephalothoracis in linea media non sulcata. Corpus vix vel non duplo longius quam latius:

1. Segmenta dorsalia omnia sulco, in linea media corporis posito, destituta. Articulus tertius antennarum saltem plus quam quadruplo brevior quam pars ceterior articuli secundi:

a. Excavationes laterales anteriores cephalothoracis transversim plicatae neque granulatae. Solea tarsi I saltem $\frac{4}{5}$ tarsi explens:

§. Oculi a conis fœtidis spatio, minore quam radio oculi, disjuncti.

1. *S. Beccarii* Thor.

§§. Oculi conis fœtidis subcontigui 2. *S. Thorellii* n. sp.

b. Excavationes laterales anteriores cephalothoracis vix plicatae et parce granulatae. Solea tarsi I paulum ultra $\frac{2}{3}$ tarsi explens 3. *S. Weberii* n. sp.

2. Segmenta dorsalia abdominis tria priora sulco levi, secundum lineam medianam corporis ducto, prædicta. Articulus tertius antennarum non triplo brevior quam pars ceterior articuli secundi 4. *S. modestus* n. sp.

b. Pars posterior dimidia cephalothoracis et segmenta dorsalia abdominis quinque priora sulco manifesto, secundum lineam medianam corporis ducto, ornata. Corpus manifesto plus quam duplo longius quam latius 5. *S. sulcatus* n. sp.

Stylocellus Beccarii

II. Antennarum pars citerior articuli secundi supra per plus quam $\frac{4}{5}$ longitudinis densissime granulata. Sulcus thoracicus posterior levissimus, non manifestus. (Coni fœtidi longiores quam ad basin latiores; femora I et II deorsum valde curvata) 6. *S. Sumatranus* Westw.

B. Dorsum corporis leve:

1. Antennarum pars citerior articuli secundi supra, per partem basalem non tertiam, granulata. Solea tarsi I plus quam $\frac{2}{3}$ articuli explens. Pes I dimidio longior quam corpus. (7. *S. lionotus* Poc.)
2. Antennarum pars citerior articuli secundi supra ultra medium granulata. Solea tarsi I vix $\frac{3}{5}$ articuli explens. Pes I per paullo longior quam corpus, robustus. 8. *S. Pocockii* n. sp.

1. *Stylocellus Beccarii* Thor.

Tab. I., figg. 1 a—1 z.

5.5—5.8 mm. longus, vix duplo longior quam latior, niger, ferrugineo vix tintus; dorsum densissime granulatum, sulco medio destitutum; excavations anteriores transversim plicatae neque granulatae; oculi suborbiculares a conis fœtidis spatio, minore quam radio oculi, disjuncti; coni fœtidi æque longi atque ad basin lati, apice rotundate truncato; antennarum articulus secundus plus quam quintuplo longior quam latior, area basali perminuta granulata, articulus tertius quadruplo brevior quam secundus; stomotheca duplo et dimidio longior quam latior; femora I levissime, II vix, deorsum curvata; tibiae I vix dimidio longior quam patella, IV circiter triplo longior quam crassior; solea tarsi I circiter $\frac{4}{5}$ articuli explens; eminentia tarsi IV maris ultra medium articuli posita, parte basali longiore quam ad basin crassiore.

1882. ♂ Leptopsalis Beccarii Thorell ('Ann. d. Mus. civ. d. stor. nat. d. Genova', vol. XVIII., p. 25, T. IV., figg. 1—9).

1890. *Stylocellus Sumatranus* Thorell (*Ibid. Ser. 2*, vol. x., p. 106).

1891. *Stylocellus Sumatranus* Thorell (*Ibid. Ser. 2*, vol. x., p. 766).

Corpus vix duplo longius quam latius. Dorsum totum subtiliter densissime granulatum, granulis posteriora versus sensim paullulo minoribus. Coxæ et pedes densissime granulati. Venter subtilissime granulatus, segmenta secundum et tertium non ubique densissime.

Cephalothorax sulco levissime et æqualiter procurvo limitatus. Carina dorsualis non duplo longior quam ante latior, manifesto brevior quam articulus primus antennarum; pars anterior triangula manifesto excavata, in lateribus rotundata. Excavations anteriores laterales transversim manifesto plicatae (neque granulatae), in sulcos, dorsum vix attingentes, continuatae. Sulcus posterior fortiter arcuatus

Oculi succinei suborbiculares margini superiori coni fœtidi paullo propiores quam inferiori, a basi coni spatio manifesto separati, quod tamen radio oculi minus est, et a margine laterali cephalothoracis spatio disjuncti, quod diametro oculi circiter duplo majus est.

Coni fœtidi a margine laterali corporis paullum remoti; desuper inspecti æque longi atque ad basin lati, ad apicem rotundate truncatum versus paullo angustiores.

Ventris sulci laterales obliqui longe pone coxas IV desinunt. Segmentum tertium depressione in femina levi et ampla in mare fere inconspicua, præditum. Sulci transversi priores tres extra impressiones musculares leniter prorsum arcuati. Operculum anale parte circiter tertia latius quam longius

Antennarum articulus primus desuper inspectus triplo longior quam ad basin latior, ad basin saltem æque latus atque conus fœtidus, ubique dense granulatus; tuberculum exterius ad apicem coxae I positum. Pars citerior articuli secundi fere fusiformis articulo primo plus quam dimidio longior, plus quam quintuplo longior quam latior, nitida lœvis, area dorsuali perminuta, ad ipsam basin posita, subtiliter granulata. Articulus tertius parte citeriore articuli secundi quadruplo brevior.

Stomotheca duplo et dimidio longior quam ante latior.

Pedes minus robusti. Facies inferior coxae I per paullo humilior quam ea coxae II. Femora I levissime, II vix, deorsum curvata, III et IV recta. Tibiae desuper inspectae omnes vix dimidio

longiores quam patellæ; III duplo et dimidio, IV circiter triplo longiores quam crassiores. Metatarsus IV supra leviter lateque impressus, in mare manifesto, in femina vix. Tarsi (ubi crassissimi) tibiis: I paullo crassior, II et III manifesto tenuiores. Solea tarsi I circiter $\frac{4}{5}$ articuli explens.

Differentia sexualis: Tarsus IV tibia, maris vix tenuior et paullo angustior, feminæ manifesto tenuior et angustior.—Eminentia dorsualis tarsi IV maris paullum ultra medium articuli posita; pars basalis subconica, longior quam ad basin crassior; pars apicalis parte basali manifesto brevior, paullum curvata.—*Maris* operculum genitale sulco posteriore manifesto limitatum, præsertim pone granulatum, multo brevius quam ad basin latius, ante rotundatum et in apice leviter lateque productum; areuli genitales pone subparallelis, sat angusti, humiliores, secundum aperturam genitalem carinati, quæ carinae antrorsum sensim altiores sunt, quare in elevationes subapicales producti sunt areuli, altas obtusas, intervallum sat latum relinquentes, cujus in fundo ipsi apices arcuorum videntur. *Feminae* operculum genitale manifesto limitatum, impressionibus irregularibus ornatum, æque latum atque longum, ante rotundatum; areuli genitales pone leviter divergentes, ante alte convexi, subcostati, costæ in angulos acutos productæ, introrsum leviter inclinatos, aliquantum ante marginem anteriorem operculi positos.

Niger, ferrugineo vix tinctus. Antennarum articulus primus ejusdem coloris cujus corpus; secundus castaneus. Palpi brunnescentes. Pedes nigri, ferrugineo manifesto tincti.

Long. corp. ♂ alterius 5·7, ♀ 5·75 mm.; long. cephaloth. ♂ ♀ 2·5 mm.; lat. max. ♂ 2·9, ♀ 3 mm.; antennæ ♂ ♀ 3·6 mm.; palpi ♂ ♀ 3·5 mm.; pedes I ♂ 7·4, ♀ 6·8 mm.; II ♂ 6·3, ♀ 5·8 mm.; III ♂ 6, ♀ 5·75 mm.; IV ♂ 7·25, ♀ 7·1 mm.—Mas alter 5·5 mm. longus.

Patria: Sumatra, ubi in Monte Singalang et Siboga captus. Exempla tria perlustravimus, mares duos ab ill. Thorell descriptos et feminam, in Museo civico Genuæ conservata, quæ benevolentiae cl. Dr. R. Gestro debemus.

2. *Stylocellus Thorellii* n. sp.

Tab. I., figg. 2 a—2 d.

Femina 5·8 mm. longa, manifesto non duplo longior quam latior, nigra, ferrugineo vix tincta; dorsum densissime granulatum, sulco medio destitutum; segmenta ventralia majora quinque priora præter granula subtilia pauca punctis latis leviter impressis ornata; excavationes anteriores transversim plicatæ neque granulatæ; oculi elliptici basi coni fœtidi vicini subcontigui; coni fœtidi paullo breviores quam ad basin latiores, ad apicem rotundate truncatum versus aliquanto angustiores; antennarum articulus secundus quintuplo et dimidio longior quam latior, area basali perminuta granulata, articulus tertius articulo secundo pene quintuplo brevior; stomothecea triplo longior quam latior; femora I levissime, II vix, deorsum curvata; tibia I vix dimidio longior quam patella IV, circiter triplo longior quam crassior; solea tarsi I circiter $\frac{5}{6}$ articuli explens.

Corpus manifesto non duplo longius quam latius. Dorsum subtilissime dense granulatum; segmentum thoracicum et abdominalia primum et secundum in lateribus nitida, sublaevia. Coxæ I densissime, ceteræ dense granulatæ. Segmenta ventralia secundum et tertium subtilissime parce, quartum, quintum, sextum vix granulata, septimum, octavum, nonum densissime subtilissime granulata; majora quattuor quinque punctis latis leviter impressis ornata.

Cephalothorax omnino ut in specie præcedente constructus.

Oculi succinei manifesto elliptici, obliqui, basi coni fœtidi vicini subcontigui, margini superiori coni fœtidi paullo propiores quam inferiori, a margine lateralí corporis spatio separati, quod diametro magna oculi non duplo majus est.

Coni fœtidi a margine lateralí corporis paullum remoti; desuper inspecti paullo breviores quam ad basin latiores, ad apicem rotundate truncatum versus aliquanto angustiores.

Venter. Ante sulcos laterales obliquos, longe pone coxas IV desinentes, adsunt fossulæ singulæ profundæ¹, impressione ampla levi circumdatae. Segmenta secundum et tertium depressione communi media levi ampla predata. Sulci transversi priores tres extra impressiones musculares fere sub angulo oblique prorsum directi. Operculum anale pene dimidio latius quam longius.

¹ Qui character forsitan nullius momenti est.

Antennarum articulus primus desuper inspectus plus quam triplo longior quam ad basin latior, ad basin angustior quam conus foetidus, ubique dense granulatus; tuberculum exterius adversus apicem coxae I positum. Pars cterior articuli secundi plus quam dimidio longior quam primus, quintuplo et dimidio longior quam latior, laevis, nitida, area dorsuali perminuta, ad ipsam basin posita, subtiliter granulata. Articulus tertius articulo secundo pene quintuplo brevior.

Pedes minus robusti a pedibus speciei praecedentis vix differunt; solea tamen tarsi circiter $\frac{2}{3}$ articuli explet.

Differentia sexualis: Mas incognitus. Feminae operculum genitale pone haud manifesto limitatum, ante truncatum (vel vix emarginatum) sulco profunde impresso recurvo in partes duas divisum, quarum anterior plana est, quem posterior, pene duplo longior, valde fornicata sit. Arculi genitales pone leviter divergentes, carinis subinterioribus ornati, in angulos vix acutos productis, aliquantum ante marginem anteriorem operculi positos.

Niger, ferrugineo vix tinctus. Articulus primus antennarum ejusdem coloris ejus corpus; secundus castaneus. Palpi brunnescentes. Pedes nigri, ferrugineo manifeste tincti.

Long. corp. 5·8 mm.; long. cephaloth. 2·5 mm.; lat. max. 3 mm.; antennae 3·4 mm.; palpi 3·8 mm.; pedes I 7; II vix ultra 6; III vix 6; IV 7·5 mm.

Patria: Sumatra. Feminam unicam perlustravimus, in Monte Singalang a cl. Beccari captam, in Museo civico Genuae conservatam, quam benevolentiae cl. Dr. R. Gestro debemus.

Hæc species *Stylocello Beccarii* Thor. simillima est.

3. *Stylocellus Weberii* n. sp.

Tab. II., figg. 1a—1e.

Mas 4·6 mm. longus, manifesto non duplo longior quam latior, niger, ferrugineo leviter tinctus; dorsum densissime granulatum, sulco medio destitutum; excavationes anteriores vix plicatae et parce granulatae; oculi elliptici basi coni foetidi vicini subcontigui; coni foetidi aequi lati atque longi, apicem subtruncatum versus paullo angustiores; antennarum articulus secundus quadruplo et dimidio longior quam latior, area basali minuta granulata, articulus tertius paullo plus quam quadruplo brevior quam secundus; stomotheca duplo et dimidio longior quam latior; femora I leviter, II levissime, deorsum curvata; tibiae I non dimidio longior quam patella, IV non triplo longior quam crassior; solea tarsi I paulum ultra $\frac{2}{3}$ articuli explens; euminentia tarsi IV maris ultra medium articuli posita, parte basali manifesto compressa breviore quam ad basin crassiore.

1892. *Stylocellus Sumatranaus* Loman ('Max Weber: Zool. Ergebnisse', III., p. 26).

Corpus manifesto non duplo longius quam latius. Dorsum ante densissime granulatum, granulis posteriora versus sensim minoribus, ita ut pars postrema coriacea appareat. Coxæ et pedes densissime granulati. Segmenta ventralia secundum et tertium parce subtiliter, quartum, quintum, sextum vix, cetera et operculum anale dense granulata.

Cephalothorax sulco levissime et aequaliter procurvo limitatus. Carina dorsualis non duplo longior quam ante latior, vix brevior quam articulus primus antennarum; pars anterior triangula manifesto excavata, in lateribus fere costis limitata. Excavationes anteriores laterales vix plicatae et parce granulatae, in sulcos dorsum attingentes continuatae. Sulcus posterior fortiter arcuatus.

Oculi succinei manifesto elliptici, obliqui, margini inferiori coni foetidi vix propiores quam superiori, basi coni subcontigui, a margine laterali corporis spatio remoti, quod diametro magna oculi dimidio majus est.

Coni foetidi margini laterali corporis subcontigui; desuper inspecti aequi lati atque longi, apicem subtruncatum versus paullo angustiores.

Ventris sulci laterales obliqui longe pone coxas IV desinunt. Ante sulcum transversum primum carina transversa humilis rotundata adest, ante quam venter subplanus est. Sulci transversi priores tres extra impressiones musculares leniter prorsum arcuati. Operculum anale dimidio latius quam longius.

Antennarum articulus primus paullo plus quam triplo longior quam ad basin latior, ad basin manifesto angustior quam conus foetidus, ubique dense granulatus; tuberculum exterius post

apicem coxae I positum. Pars citerior articuli secundi leviter fusiformis plus quam dimidio longior quam articulus primus, circiter quadruplo et dimidio longior quam latior, nitida laevis, area dorsuali basali minuta subtiliter granulata. Articulus tertius parte citeriore articuli secundi paullo plus quam quadruplo brevior.

Stomotheca duplo et dimidio longior quam ante latior.

Pedes robusti. Femora I leviter, II levissime, deorsum curvata. Tibiae desuper inspectae omnes non dimidio longiores quam patellæ; III paullo plus quam duplo, IV non triplo longiores quam crassiores. Metatarsus IV supra haud convexus. Tarsi II et III tibias aliquanto tenuiores. Solea tarsi I paulum ultra $\frac{2}{3}$ articuli explens. Ceterum pedes a pedibus Stylocelli Beccarii non differunt.

Differentia sexualis: Femina incognita. Tarsus IV vix tenuior et manifesto angustior quam tibia. Eminentia dorsualis tarsi IV paullo ultra medium posita; pars basalis manifesto compressa, brevior quam ad basin crassior; pars apicalis parte basali paullo longior, curvata.—Operculum genitale pone sulco haud manifesto limitatum, multo latius quam longius, ante leviter rotundatum et in apice breviter rotundate triangule productum. Arculi genitales pone late divergentes, carinis subterioribus levibus, in angulos obtusos productis, ornati.

Niger, ferrugineo leviter tinctus; venter nigro-purpureus. Articulus primus antennarum ejusdem coloris cuius dorsum; secundus dilute brunnescens. Palpi sordide fulvo-testacei. Pedes fusco-brunnei.

Long. corp. 4·6 mm.; long. cephaloth. 1·9 mm.; lat. max. 2·5 mm.; antennæ 2·6 mm.; palpi 3 mm.; pedes I 6·3; II 5; III 4·5; IV 6·3 mm.

Patria: Sumatra. Specimen unicum, marem, perlustravimus, quod cl. professor Max Weber ad Manindjau collegit et nobis benevolentissime accommodavit.

4. *Stylocellus modestus* n. sp.

Tab. II., figg. 2a—2f.

4·3 mm. longus, non duplo longior quam latior, castaneus; dorsum densissime granulatum, segmentis abdominalis prioribus tribus sulco medio levi ornatis; excavationes anteriores fortiter plicatae neque granulatae; oculi suborbiculares a basi coni fætidi spatio, minore quam radio oculi, separati; coni fætidi paullo breviores quam latiores, apicem subtruncatum versus multo angustiores; articulus secundus antennarum circiter quadruplo longior quam latior, area basali, non tertiam partem longitudinis occupante, granulata, tertius secundo non triplo brevior; stomotheca paullo ultra $\frac{2}{3}$ vel vix duplo longior quam latior; femora I sat leviter, II levissime, deorsum curvata; tibiae I tertia parte longior quam patella, IV duplo et dimidio longior quam crassior; solea tarsi I non $\frac{2}{3}$ articuli explens; eminentia tarsi IV maris ultra medium posita, parvula, erecta, parte basali subæque crassa atque alta.

Corpus manifesto non duplo longius quam latius. Cephalothorax, coxae, pars anterior segmenti ventralis secundi densissime subtiliter granulata; segmenta dorsalia abdominalia priora tria subtilissime granulata, latera versus sublaeve, et linea leviter impressa media per longitudinem ducta praedita; dorsum reliquum in medio subtilissime granulatum, in lateribus sublaeve; venter reliquus sublaevis. Pedes dense subtilissime granulati.

Cephalothorax sulco leviter et æqualiter procurvo limitatus. Carina dorsualis angusta, pene triplo longior quam ante latior et paullo (tamen manifesto) longior quam articulus primus antennarum; pars anterior triangula manifesto concava, in lateribus rotundata. Excavationes anteriores laterales fortiter transversim plicatae, neque granulatae, in sulcos latos dorsum attingentes continuatae. Sulcus posterior fortiter arcuatus; pars media marginem posteriorem cephalothoracis fere attingit.

Oculi magni, suborbiculares, fusco-brunnei, margini superiori coni fætidi tam propinquai, ut linea, marginem superiore utriusque tangens, librata sit; a basi coni spatio separati, quod radio oculi minus est; a margine laterali corporis spatio remoti, quod diametro oculi vix duplo majus est.

Coni fætidi a margine laterali corporis paullum remoti, paullo breviores quam ad basin latiores, apicem subtruncatum versus multo angustiores.

Ventris sulci laterales obliqui coxas IV intra spiracula attingunt. Segmentum tertium excavatione media ampla, in femina levi, in mare subevanida, praeditum. Sulci transversi priores tres extra

impressiones musculares leniter antrorum arcuati. Operculum anale sat convexum, paullo latius quam longius.

Antennarum articulus primus pene triplo longior quam ad basin latior, ad basin paullo angustior quam conus fætidus, ubique dense granulatus; tuberculum exterius adversus apicem coxae I positum. Pars ceterior articuli secundi dimidio longior quam primus, circiter quadruplo longior quam latior, laevis, area basali minore granulata, non tertiam partem articuli explente. Articulus tertius non triplo brevior quam pars ceterior secundi.

Stomotheca paullo plus duabus partibus tertis aut vix duplo longior quam ante latior.

Pedes breves et robusti. Facies inferior coxae I vix minus alta quam ea coxae II. Femora sat leviter, II et IV levissime, deorsum curvata, III rectum. Tibiae desuper inspectae I parte tertia, ceterae paullo longiores quam patellæ; III circiter duplo, IV duplo et dimidio longiores quam crassiores. Metatarsi omnes haud triplo breviores quam tarsi. Tarsi tibiis: I paullo crassior, II manifesto, III vix, IV paullo tenuiores. Solea tarsi I non $\frac{2}{3}$ articuli explet. Impressiones lineares dorsuales tarsorum I et II levissimæ.

Differentia sexualis: Tarsus IV utriusque sexus manifesto angustior quam tibia, et in mare manifesto latior in medio. Eminentia dorsualis tarsi IV maris ultra medium articuli posita, parvula, erecta; pars basalis conica, subæque alta atque in basi crassa; pars apicalis subulata triplo longior quam pars basalis.—*Maris* operculum genitale dense granulatum, pone vix limitatum, ante manifesto rotundate triangule productum. Arculi genitales pone late divergentes, ad basin manifesto impressi, sat lati, transversim convexi, in angulos rotundatos, subapicales, prominentes producti.—*Feminæ* operculum genitale granulatum, pone haud manifesto limitatum, vix longius quam ad basin latius, vix convexum et secundum marginem rotundatum anteriorem costatum, quoniam sulco submarginali prædictum est. Arculi genitales pone paullum divergentes; pars posterior (operculo contigua) transversim convexa vixque carinata; pars anterior alte carinata, in angulum acutum, longe ante marginem anteriorem operculi positum, producta.

Corpus et antennæ castanea. Palpi et pedes fulvo-castanei.

Long. corp. ♂ ♀ 4.3 mm.; long. cephaloth. ♂ ♀ 2 mm.; lat. max. ♂ ♀ 2.4 mm.; antennæ ♂ ♀ 2 mm.; palpi ♂ 2.8, ♀ 2.7 mm.; pedes I ♂ 4.8, ♀ 4.5 mm.; II ♂ 4.3, ♀ 3.9 mm.; III ♂ ♀ 3.9 mm.; IV ♂ 4.6, ♀ 4.5 mm.

Patria: Celebes orientalis. Marem et feminam perlustravimus, ad Bua-Kraeng, quæ specimina benevolentiae ill. E. Simon debemus.

5. *Stylocellus sulcatus* n. sp.

Tab. II., figg. 3a—3h.

Non 4 mm. longus, manifesto plus quam duplo longior quam latior, castaneus, pedibus castaneo-fulvis; dorsum densissime granulatum, parte posteriore dimidia cephalothoracis et segmentis abdominalis prioribus quinque sulco medio ornatis; excavationes anteriores granulatae, vix plicatae; oculi suborbiculares a basi coni fætidi spatio, minore quam diametro oculi, separati; coni fætidi breviores quam latiores, apicem rotundatum versus aliquanto angustiores; articulus secundus antennarum non-nihilo plus quam triplo longior quam latior, area basali, vix dimidium articulum occupante, granulata, articulus tertius circiter duplo et dimidio brevior quam secundus; stomotheca circiter dimidio longior quam latior; femora I leviter deorsum curvatum, II rectum; tibiae I haud quarta parte longior quam patella, IV duplo longior quam crassior; solea tarsi $\frac{3}{4}$ articuli explens. Eminentia tarsi IV maris paullum citra medium posita, parva, suberecta.

Corpus manifesto plus quam duplo longius quam latius. Dorsum ubique densissime granulatum, granulis posteriora versus sensim minoribus. Coxæ densissime, pedes densissime at subtilissime granulati. Venter densissime et subtilissime granulatus et punctis leviter impressis parce ornatus. In dorso sulcus (sive stria impressa lata) adest, adversus conos fætidos oriens et in segmento abdominali quinto desinens, in segmento thoracico autem deletus et in segmento abdominali primo perlevis.

Cephalothorax sulco, in medio sat fortiter procurvo, limitatus. Carina dorsualis vix dimidio longior quam ante latior, subæque longa atque articulus primus antennarum; pars anterior triangula manifesto excavata, costis lateralibus destituta. Excavationes anteriores laterales granulatae, vix plicatae, in sulcos levissimos, sulcum posteriore attingentes, continuatae. Ante et subter oculos costæ singulæ obliquæ adsunt, marginem lateralem corporis attingentes. Sulcus posterior fortiter arcuatus, in medio marginem cephalothoracis fere tangens.

Oculi succinei suborbiculares, margini superiori coni fœtidi multo propiores quam inferiori; a basi coni spatio, manifesto minore quam diametro oculi, separati; a margine laterali corporis spatio remoti, quod diametro oculi non duplo majus est.

Coni fœtidi a margine laterali corporis spatio, diametro oculi æquali, disjuncti; desuper inspecti manifesto breviores quam ad basin latiores, apicem rotundatum versus aliquanto angustiores.

Ventris sulci laterales obliqui longe pone coxas IV desinunt. Segmenta secundum et tertium depressione communi media levi ampla praedita. Sulci transversi priores tres extra impressiones musculares vix antrorum arcuati. Operculum anale sat convexum, vix dimidio latius quam longius.

Antennarum articulus primus non triplo longior quam ad basin latior, ad basin angustior quam conus fœtidus, ubique dense granulatus; tuberculum exterius adversus apicem coxae I positum. Pars ceterior articuli secundi vix fusiformis, dimidio longior quam primus, plus triplo longior quam latior; pars dorsualis basalis vix dimidia granulato-coriacea. Articulus tertius parte ceteriore articuli secundi circiter duplo et dimidio brevior.

Stomotheca circiter dimidio longior quam ante latior.

Pedes breves robusti. Facies inferior coxae I æque alta atque ea coxae II. Femora I deorsum leviter curvatum, cetera recta. Tibiae desuper inspectæ I et IV haud parte quarta, II et III paullulo longiores quam patellæ; III dimidio, IV duplo longiores quam crassiores. Tarsi tibiis manifesto tenuiores. Solea tarsi I $\frac{3}{4}$ articuli explet.

Differentia sexualis: Sulcus cephalothoracem limitans in mare fortius curvatus quam in femina. Tarsi omnes crassiores in mare quam in femina. Tarsus IV utriusque sexus manifesto angustior quam tibia; maris in medio vix latior et non crassior; eminentia dorsualis paullum citra medium posita, parva, suberecta; pars basalis est tuberculum vix conicum, vix altius quam ad basin crassius; pars apicalis duplo altior, recta.—*Maris* operculum genitale sublæve, punctis impressis nonnullis ornatum, pone non limitatum, latius quam longius. Arculi genitales pone late separati et paullum divergentes, ante aperturam genitalem sat alte et crasse elevati; elevatio ad lineam medianam corporis et utrinque eandem prope in tuberculata duo et angulos duos partita.—*Feminae* operculum genitale dense granulatum, pone haud manifesto limitatum, latius quam longius, pone convexum, in parte anteriore dimidia declive et secundum marginem anteriorem rotundatum costatum, quoniam depressione submarginali praeditum est. Arculi genitales pone sat divergentes; pars posterior paulum convexa; pars anterior alte convexa et fere carinata; anguli subacuti longe ante marginem anteriorem operculi positi.

Corpus et antennæ castanea, conis fœtidis castaneo-fulvis. Pedes fulvi. Palpi testaceo fulvi, apicem versus sensim dilutiores.

Long. corp. ♂ 3·75, ♀ 3·9 mm.; long. cephaloth. ♂ ♀ 1·6 mm.; lat. max. ♂ 1·5, ♀ 1·75 mm.; antennæ ♂ ♀ 2 mm.; palpi ♂ ♀ 2·6 mm.; pedes I ♂ 4·25, ♀ 4·1 mm.; II ♂ ♀ 3·5 mm.; III ♂ 3, ♀ 3·3 mm.; IV ♂ 4, ♀ 4·1 mm.

ANIMAL ADOLESCENS 3 mm. longum, 1·6 latum, præsertim hisce in rebus ab animale adulto discrepat: Relative manifesto latius et multo humilius (fere deplanatum).

Sulcus medius, per longitudinem corporis ductus, cephalothoraci deest¹, sed per segmenta abdominalia septem ductus est; quo in sulco cutis mollis est.

Segmenta dorsalia abdominalia omnia inter sese et a cephalothorace libera; ventralia sex posteriora libera (secundum autem cum coxis IV et cum tertio coalitum). Quod cutis mollis, segmenta uniens, sat lata est, figura (præsertim dorsalis) animalis junioris ab ea adulti satis differt: nam striæ latæ granulatae (segmenta) et striæ angustæ læves (cute molli formatæ) alternant.

Coni fœtidi margini laterali corporis contigui; desuper inspecti oblique truncati (ita ut latus posterius manifesto brevius sit quam latus anterius); nodulus apicalis angulo anteriori impositus.

Pedes aliquanto graciliores.

Dorsum et venter ferruginea; antennæ et pedes fulvi; membra cetera fulvo-testacea.

Patria: Java occidentalis. Marem et feminam et animal adolescens perlustravimus, in Monte Gédé collecta, quæ ill. E. Simon nobis benevolentissime accommodavit.

¹ Adsunt autem leves sulci, excavationes anteriores laterales continuantes.

6. *Stylocellus Sumatranus* Westw.

Tab. II., figg. 4 a—4 c.

Mas 6 mm. longus, plus quam duplo longior quam latior, niger, purpureo tinctus; dorsum densissime granulatum sulco medio destitutum; sulcus thoracicus posterior vix manifestus; excavationes anteriores granulatae et parce plicatae; oculi elliptici a basi coni fetidi spatio, diametrum oculi paullulum superante, separati; coni fetidi longiores quam latiores, apicem rotundate truncatum versus per paullo angustiores; articulus secundus antennarum paullo plus triplo longior quam latior, per plus quam $\frac{4}{5}$ articuli densissime granulatus, tertius paullo plus duplo brevior quam secundus; stomotheca paullo plus dimidio longior quam latior; femora I valde, II aliquantum deorsum curvata; tibiæ I parte tertia longior quam patella, IV?; solea tarsi I $\frac{2}{3}$ articuli explens; eminentia tarsi IV maris?

1874. *Stylocellus Sumatranus* Westwood ('Thesaur. Oxon.', p. 200, Tab. xxxvii., fig. 7).

Corpus per paullo plus duplo longius quam latius. Dorsum ubique densissime et minus subtiliter granulatum; granula anteriores vix majora quam posteriores. Coxæ et venter totus densissime, pedes densissime subtiliter granulati.

Cephalothorax sulco levissime arcuato limitatus. Carina dorsalis haud bene expressa, lata, paullo longior quam ante latior, parte sua dimidia brevior quam articulus primus antennarum; pars anterior triangula propter robustas antennas magna, leviter excavata, costis lateralibus non limitata. Excavationes anteriores laterales eodem modo granulatae, quo pars reliqua cephalothoracis, et parce transversim plicatae. Sulcus posterior levissimus, vix manifestus.

Oculi fusi manifesto elliptici, vix obliqui (a linea media corporis ante levissime divergentes), margini superiori coni fetidi propiores quam inferiori, a basi coni spatio separati, quod diametrum magnam oculi paullulo superat, et a margine laterali corporis spatio disjuncti, quod eadem diametro plus duplo majus est.

Coni fetidi a margine laterali corporis spatio separati, quod diametro basali dimidiae coni subæquale est; desuper inspecti longiores quam ad basin latiores, apicem rotundate truncatum versus per paullo angustiores.

Ventris sulci laterales obliqui longe pone coxas desinunt. Ante sulcum transversum primum depresso levissima longa media adest. Sulci transversi priores tres extra impressiones musculares manifesto prorsum arcuati. Operculum anale vix convexum, non dimidio latius quam longius.

Antennarum robustarum articulus primus triplo longior quam ad basin latior, ad basin latior quam conus fetidus; tuberculum exterius parvum ante apicem coxae I positum. Pars cterior articuli secundi paullo longior quam articulus primus, paullo plus triplo longior quam latior, depresso fusiformis, supra per plus quam $\frac{4}{5}$ et extra per partem dimidiæ basalem densissime granulata, infra sublævis, nitida. Articulus tertius paullo plus duplo brevior quam pars cterior secundi.

Stomotheca paullo plus dimidio longior quam ante latior.

Pedes robusti. Facies inferior coxae I vix minus alta quam ea coxae II. Femora I valde, II manifesto, deorsum curvata. Tibiæ desuper inspectæ I parte tertia, II parte quarta longiores quam patellæ. Tarsi I crassior, II tenuior quam tibiæ. Solea tarsi I $\frac{2}{3}$ articuli explens.

Differentia sexualis: Femina incognita. *Maris* eminentia dorsalis tarsi IV? Arculi genitales specimen unici non tam bene conservati, ut describi possint. Operculum genitale pone haud manifesto limitatum, plus duplo brevius quam pone latius, subtiliter granulatum, ante rotundatum et in apice leviter lateque productum.

Niger, purpureo tinctus. Articulus primus antennarum et pedes corpore vix dilutiores. Articulus secundus antennarum dilutior, imprimis in apice. Palpi purpureo-brunnei.

Long. corp. 6 mm.; long. cephaloth. 2·7 mm.; lat. max. 2·9 mm.; antennæ 3·2 mm.; palpi 3·5 mm.; pedes I 7·5; II 7 mm.; III?; IV?

Patria: Sumatra. Specimen unicum perlustravimus, a Westwood delineatum et breviter descriptum, quod cl. professor Poulton nobis benevolentissime accommodavit.

De Synonymia. Specimen typicum non solum pedibus III et IV caret, sed etiam asymmetricum est (partibus dextris sulciorum ventralis transversi primi et dorsualis deletis et sulcis dorsualibus quinto et septimo obliquis). Nihilo minus dicere possumus, primo statim aspectu elucidere, *S. Sumatranum* Westw. a *S. Beccarii* magnopere differre; admodum enim antennae differunt et palpi et pedes manifesto robustiores et granula corporis majora in *S. Sumatranum* quam in *S. Beccarii* sunt.

(7. *Stylocellus lionotus* Poc.)

Femina 6 mm. longa, duplo longior quam latior, nigra, membris saturate ferrugineis; dorsum laeve; area media longa coxae IV, ceterum laevis, a marginibus coxae sat distans, granulata; oculi a basi coni foetidi spatio, paullo majore quam diametro oculi, separati; area dorsualis basalis articuli secundi antennarum, paullum ultra quartam partem articuli explens, granulata; articulus tertius antennarum vix quadruplo brevior quam secundus; pes I dimidio longior quam corpus; femora I aliquantum, II leviter, deorsum curvata; solea tarsi I partem circiter quartam articuli explens.

1897. *Stylocellus lionotus* Pocock ('Ann. Nat. Hist.', Ser. 6, Vol. xix., p. 291).

Characteres sequentes benevolentia ill. Pocock dare possumus¹.

Venter abdominis laevis; coxa IV area media granulata ornata.

Oculi margini inferiori coni foetidi propiores quam superiori, a margine laterali corporis spatio remoti, quod diametro oculi majus est.

Femora I aliquantum, II et IV leviter, III levissime deorsum curvata.

Long. corp. 6 mm.; lat. max. 3 mm.; pedes I 9; II 6·3; III 6·5; IV 8·8 mm.

Patria: Sandakan, Borneo septentrionalis. Specimen typicum in Museo Britannico asservatur.

8. *Stylocellus Pocockii* n. sp.

Tab. II., figg. 5 a—5 d.

Femina 5·8 mm. longa, vix duplo longior quam latior; cephalothorax fusco-ferrugineus, abdomen et membra ferruginea; dorsum laeve; coxa IV densissime granulata, parte posteriore laevi; excavations anteriores leviter plicatae; oculi orbiculares a basi coni foetidi spatio, minore quam diametro oculi, separati; coni foetidi aequi longi atque lati, apicem rotundatum versus aliquanto angustiores; articulus secundus antennarum quadruplo longior quam latior, per partem basalem paulo plus quam dimidiam granulatus, articulus tertius paulo plus triplo brevior quam secundus; stomotheca vix dimidio longior quam latior; pes I per paullo longior quam corpus; femora I valde, II manifesto, deorsum curvata; tibiae I vix tercia parte longior quam patella, IV duplo et dimidio longior quam crassior; solea tarsi I vix $\frac{3}{5}$ articuli explens.

Corpus vix duplo longius quam latius. Dorsum laeve; segmentum ventrale sextum punctis impressis duobus, medio propinquis, praeditum, venter reliquo laevis; coxae densissime granulatae, parte posteriore coxae IV tamen laevi; pedum metatarsi et tarsi subtilissime dense granulati (vel coriacei), tibiae I et II parce, articuli ceteri vix, granulati.

Cephalothorax sulco manifeste arcuato limitatus. Carina dorsualis non duplo longior quam ante latior, brevior quam articulus primus antennarum; pars anterior triangula profunde excavata, costis limitata. Excavationes anteriores laterales leviter plicatae, in dorsum non continuatae. Sulcus posterior fortiter arcuatus, impressionibus latis duabus cum sulco, cephalothoracem limitante, fere conjunctus.

Oculi fusi orbiculares, margini inferiori coni foetidi manifesto propiores quam superiori, a basi coni spatio separati, quod diametro oculi minus est; a margine laterali cephalothoracis spatio, diametro oculi aequali, disjuncti.

¹ Diagnosin et characteres ceteros, hic communicatos, ex explicationibus et figuris, nobis ab hoc auctore benevolentissime communicatis, extraximus.

Coni fœtidi subtilissime et densissime granulati, a margine laterali cephalothoracis paullum remoti; desuper inspecti æque longi atque ad basin lati, apicem rotundatum versus aliquanto angustiores; supra fornicati, infra potius concavi.

Ventrī segmenta tertium, quartum, quintum, sextum depressionibus singulis mediis ornata, quarum prima latissima est, ante et præsertim pone tamen angustior. Ante sulcos laterales obliquos impressiones singulæ sat late adsunt. Sulci transversi priores tres subrecti. Operculum anale vix dimidio latius quam longius.

Antennarum articulus primus triplo longior quam ad basin latior, ad basin æque latus atque conus fœtidus, supra sublævis, infra subtilissime et densissime granulatus; tuberculum exterius pæne ante apicem coxæ I positum. Articulus secundus leviter fusiformis vix plus quam parte tertia longior quam primus, quadruplo longior quam latior, per partem dorsualem basilarem paullo plus quam dimidiā subtilissime et densissime granulatus, per superficiem dorsualem ceteram lævis et nitidus. Articulus tertius parte citeriore articuli secundi paullo plus quam triplo brevior.

Stomotheca vix dimidio longior quam ante latior.

Pedes robusti. Facies inferior coxæ I æque alta atque ea coxæ II. Femora I in parte apicali valde, II manifesto, III et IV vix deorsum curvata. Tibiae desuper inspectæ I vix parte tertia, ceteræ paullulo longiores quam patellæ; III non duplo, IV duplo et dimidio longiores quam crassiores. Metatarsus IV supra non impressus. Tarsi I dimidio crassior, II et III manifesto tenuiores quam tibiae. Solea tarsi I vix $\frac{3}{5}$ articuli explens, a parte basali bene limitata: tarsus ad basin soleæ dimidio crassior quam pars basalis sua.

Differentia sexualis: Mas incognitus. Tarsus IV (feminæ) manifesto tenuior et multo angustior quam tibia. Operculum genitale pone non limitatum, ante rotundatum, margine anteriore medio elevato, transversim subtiliter aciculatum; in arculis genitalibus, pone leviter divergentibus carinulæ subintiores adsunt, in angulos subacutos productæ.

Cephalothorax supra fuscus, ferrugineo tinctus; abdomen et supra et infra et membra ferruginea, coxis saturioribus; palpi luteo-brunnescentes.

Long. corp. 5·8 mm.; long. cephaloth. 2·5 mm.; long. abd. 3·5 mm.; lat. max. 3 mm.; antennæ 3·2 mm.; palpi 3·5 mm.; pedes I 6·25; II 5·5; III 5·2; IV 6·4 mm.

Patria: Borneo. Specimen unicum, feminam, vidimus, in parte Britannica septentrionali insulae (British North Borneo) a cl. S. S. Flower captum et in museo Britannico asservatum.

(9. *Stylocellus Javanus Thor.*)

Mas "Ovatus, opacus, piceo-ferrugineus, palpis testaceo-fuscis; supra et in segmento ventrali 1° [re vera: secundo et tertio] ut et in coxis subter densissime et subtiliter granulosus, pedibus ferrugineis præterea densissime et subtilissime granulosus; coxis 2ⁱ paris coxas 1ⁱ paris altitudine non parum superantibus; metatarsis et tarsis posterioribus [maris] saltem dimidio angustioribus quam sunt patellæ et tibiæ; tarsis 4ⁱ paris [maris] supra dente parvo armatis."

1882. Leptopsalis Javanus Thorell ('Ann. d. Mus. civ. d. stor. nat. d. Genova', vol. XVIII., p. 30, Tab. IV., figg. 10 and 11).

E descriptione ill. Thorell præterea referimus:

Sulcus posterior cephalothoracis in medio obsoletus. Antennarum articulus primus vix 3½ longior quam latior; secundus ad basin subtiliter granulatus; forceps paullo major et robustior quam in *S. Beccarii*, circa $\frac{1}{5}$ totius articuli secundi longitudine æqualis. Pedes breviores et robustiores quam in *S. Beccarii*. Eminentia dorsualis tarsi IV maris multo minor quam in *S. Beccarii*.—Femina incognita. 5·5 mm. longus; 3·25 latus; 2·5 altus; palpi 3 mm.; pedes I > 6·5; II > 5·5; III 5·5; IV > 6·5 mm.

Patria: Java. Specimen ab ill. Thorell descriptum, ad Teibodas captum, in museo civico Genuæ asservatum est.

(2. *Miopsalis* Thor.)

1890. *Miopsalis* Thorell ('Ann. d. Mus. civ. d. stor. nat. d. Genova', Ser. 2, vol. x., p. 381).

Hoc in loco genus *Miopsalidis* nobis incognitum commemoramus, quod ill. auctor dicit: "a Stylocello vix nisi defectu oculorum duorum sessilium ante tubercula illa duo oculigera sitorum discrepat." E descriptione ill. Thorell characteres sequentes extraximus, quibus hoc genus a genere *Stylocelli* differt:

Oculi desunt.

Antennarum articulus primus "multis partibus longior quam latior basi, usque ad medium partis patellaris palporum circiter pertinens."

Tarsi "posteriores metatarso 2½—3plo longiores, anteriores metatarso fere 4plo longiores."

Ill. Pocock ('Ann. Nat. Hist.' Ser. 6, vol. xix., p. 289) quidem putat: "*Miopsalis*, Thor...., will probably prove synonymous with *Pettalus*." Quod autem magnopere dubitamus: existimari enim non potest, figuram conorum fetidorum ab ea conorum *Stylocelli* differre; nam Thorell, investigator tam accuratus, figuram conorum non commemorat. Sed etiam Thorell diserte dicit: "...paullulo supra marginem lateralem [cephalothoracis], tuberculum oculigerum [*i.e.* conum foetidum] forte, foras directum ostendit"; sed coni *Pettali*, sursum et extrorsum directi, a margine laterali seuti late remoti sunt. Item dicit Thorell: "tarsi 1^o paris subter versus basin incrassati sunt"; quea verba nimirum demonstrant, soleam basin fere attingere nec (ut in *Pettalo*) partem minorem tarsi I explore.

Species adhuc unica Indiæ orientalis indigena.

(1. *Miopsalis pulicaria* Thor.)

2·25 mm. longa. "Trunco circa duplo et dimidio longiore quam latio, densissime et subtilissime granulato, fusco-ferrugineo; palpis fusco-testaceis, pedibus ferrugineis."

1890. *Miopsalis pulicaria* Thorell (loc. nuper cit., p. 381).

E descriptione ill. Thorell referimus:

Pars media sulci, cephalothoracem, antice sat brevi spatio fortius proclivem, limitantis, procurva. Antennarum articulus secundus sine digito articulo primo paullo longior. Palporum pars femoralis parte patellari circa duplo longior; pars tibialis non parum brevior et parte tarsali paullulo incrassata parum longior. Pedes brevissimi; patellæ paullo vel parum longiores quam latiores.

2·25 mm. longa; pæne 1 lata; palpi ca. 1·5 m.m.; pedes I 2·2; II ca. 2; III ca. 1·7; IV ca. 2 mm.

Patria: Pulo Pinang.—Specimen ab ill. Thorell descriptum—animal junius vel potius femina adulta—in museo civico Genuæ asservatum est.

3. OGOWIA n. g.

Cephalothorax ante in laminam breviorem, triangulam productus, qua carina dorsualis transversa antennarum omnino obtecta est. Pars anterior cephalothoracis carinam medianam rotundatam præbet, extra quam cephalothorax ante in lateribus excavatus est.

Segmentum ventrale nonum in media parte angustissimum, ad latera versus aliquanto latius, ubique cum octavo confluens, limite inter hæc segmenta evanido. Segmentum dorsuale nonum cum segmentis ventralibus octavo et nono confluens, ut limites omnino desint.

Oculi desunt.

Coni foetidi longiores, desuper inspecti fere oblique trianguli; extrorsum et leviter sursum directi, a margine laterali cephalothoracis spatio disjuncti, quod diametro basali coni haud minus est; nodulo apicali destituti, sed rima apicali magna librata per totam latitudinem in labia inferius et superius fissi.

Antennarum articulus primus non ad apicem partis femoralis palporum attingens, aliquantum compressus, secundum margines inferiores non angulatus, carina dorsuali subbasali transversa praeditus, sed tuberculis inferioribus destitutus. Dentes in utroque ramo forcepis positi inter se subæquales, sat humiles; dentes in ramo fixo positi latiores et paullo humiliores quam in ramo mobili.

Palporum pars trochanterica minus gracilis, compressa, ad apicem versus aliquanto latior et crassior, inermis, parte femorali vix brevior; pars femoralis robusta, valde compressa, vix dimidio longior quam crassior, supra et præsertim infra convexa; partes ceteræ teretes, tarsalis perpaullo longior quam tibialis.

Coxa I in processum triangulum ante producta; spatium inter angulum anteriorem coxae et angulum anteriorem prominentem carinæ, stomothecam limitantis, paullo plus dimidio brevior quam carina stomothecæ. Stomotheca in parte anteriore sensim leviter angustata, in ipsa parte basali valde angustata (in specie adhuc cognita unica vix dimidio longior quam latior). Pars mollis lobi maxillaris coxae I, quoad videre potuimus, omnino indivisa.

Coxa I nonnihil latior quam II et III et aliquanto angustior quam IV.

Metatarsi omnes circiter duplo breviores quam tarsi.

Solea tarsi I insignis, partem ulteriorem tarsi manifesto breviorem explens, a parte citeriore manifesto limitata.

Tarsi I et II supra per longitudinem non sulcati.

Unguiculi inermes, omnes inter se longitudine æquales.

Differentia sexualis incognita (mare speciei unicæ incognito).

(Species adhuc unica pilis pallidis clavi-fusiformibus ornata est.)

Species adhuc unica magnitudine mediocris, Africæ australis indigena.

1. *Ogovia grossa* n. sp.

Tab. II., figg. 6a—6b; Tab. III., figg. 1a—1g.

Femina 3·75 mm. longa, alte convexa, $\frac{2}{3}$ longior quam latior, fusca, palpis pedibusque fulvo-brunneis; cephalothorax densissime granulatus et per partem majorem granis permagnis minus dense ornatus; segmenta dorsalia abdominis priora septem sulco medio praedita, singula præter granula dispersa ordine posteriore granorum magnorum et ordine anteriore granorum minorum ornata; excavationes anteriores granulis densissimis scabre neque plicatae; articulus secundus antennarum circiter triplo et dimidio longior quam latior, lœvis, articulus tertius articulo secundo vix plus quam duplo brevior; stomotheca vix dimidio longior quam latior; femur I leviter deorsum curvatum; tibiae I paullulo longior quam patella, IV vix duplo longior quam crassior; solea tarsi I $\frac{2}{3}$ articuli explens.

Corpus alte convexum, $\frac{2}{3}$ longius quam latius. Cephalothoracis pars anterior minor densissime granulata et pars posterior præter granula granis permagnis minus densis ornata. Segmenta dorsalia abdominis priora septem singula ordine posteriore granorum magnorum et ordine subanteriore granorum minorum et granulis dispersis densissimis ornata. Segmentum octavum granis magnis et granulis dispersis præeditum. Coxæ granis, pone sensim majoribus, densis ornatae. Venter granis, pone sensim minoribus, densissimis. In dorso adest sulcus (sive stria impressa) sat profundus medius, per segmenta abdominalia priora septem ductus. Partes palporum trochantericae parce et femoralis densissime subtiliter granulatae; ceteræ lœves. Pedes densissime et subtilissime granulati.

Pili pallidi crassi clavi-fusiformes adsunt: in dorso ante pauci, posteriora versus sensim densiores, breviores quam pili similes pedum; in segmentis ventralibus quattuor posterioribus pauci (præter pilos breves graciles acutos, pone densiores); in dorso articuli primi antennarum pauci; in dorso partium trochantericæ et femoralis palporum fere nulli; in dorso et lateribus trochanterum, femorum, patellarum, tibiæ, quum in latere inferiore horum articulorum pili graciles, acuti adsint, quibus pili clavi-fusiformes intermixti sunt; in dorso et lateribus metatarsorum et partis propioris tarsorum pili clavi-fusiformes et intermixti graciles acuti.

Cephalothorax sulco subrecto limitatus, in medio tamen breviter acute refrorsum producto. Carina dorsalis in laminam ante rotundatam producta, post apicem vix angustior, per totam longitudinem transversim convexa, pene dimidio longior quam ante latior, articulo primo antennarum manifesto brevior. Excavationes anteriores laterales granulis densissimis scabrae (non plicate). Sulcus posterior sat fortiter arcuatus: pars media ejus a sulco, cephalothoracem limitante, spatio separata, quod pene duplo brevius est quam spatium, sulcum, cephalothoracem limitantem, et sulcum primum abdominis disjungens.

Coni fœtidi paullo breviores quam latiores, densissime granulati. Apex brevis deplanatus et desuper inspectus rotundatus; margo labii superioris costatus, laevis. Ante-infra apicem coni impressi sunt.

Venter totus convexus. Sulci laterales obliqui intra spiracula antrorum curvati, coxas attingunt. Sulci transversi priores tres in medio manifesto recurvi (sive pone concavi), extra impressiones musculares prorsum vix arcuati. Operculum anale sat convexum, granulatum, paullo latius quam longius.

Antennarum artculus primus pene triplo longior quam ad basin latior, ad basin manifesto angustior quam conus fœtidus, supra dense subtiliter granulatus. Pars citerior articuli secundi paullo (non parte tercia) longior quam artculus primus, circiter triplo et dimidio longior quam latior; a latere inspectus leviter fusiformis, supra laevis. Articulus tertius parte citeriore articuli secundi vix plus quam duplo brevior.

Stomotheca vix dimidio longior quam ad apicem latior.

Palpi antennis paullo longiores. Partes trochanterica parce et femoralis densissime subtiliter granulatae; ceterae laeves pilis brevibus haud dense vestitae. Pars patellaris manifesto deorsum curvata, apicem versus manifesto sensim latior et crassior, circiter dimidio brevior quam partes ulteriores. Pars tibialis parte patellari manifesto tenuior et parte tarsali perpaullo brevior.

Pedes perbreves, robustissimi. Bases (interiores) coxarum et arculi genitales pilis longioribus sat dense vestiti. Facies inferior coxae I vix humilior quam ea coxae II. Femora I leviter, II levissime, deorsum curvata, cetera recta; II impressione linearie, leviter obliqua, exteriore et superiore ornatum. Tibiae patellis paullulo longiores et manifesto crassiores; III circiter dimidio et IV vix duplo longiores quam crassiores. Tarsi tibiis I vix, ceteri manifesto, tenuiores. Solea tarsi I $\frac{2}{5}$ articuli explens.

Differentia sexualis: Mas incognitus. *Femineæ* tarsus IV manifesto angustior quam tibia.—Operculum genitale pone non limitatum, triangulum, ante tamen peranguste truncatum, impressione transversa valde recurva, breviter post apicem posita, praeditum. Arculi genitales a coxis IV non limitati, convexi, in angulum apicale obtusum producti.

Color: Dorsum et venter et artculus primus antennarum fusca (vel brunneo-fusca). Articuli secundus et tertius antennarum et pedes fulvo-brunnei. Palpi fulvo-brunnei, articulis ulterioribus tribus dilutioribus.

Long. corp. 3·75 mm.; long. cephaloth. 1·6 mm.; lat. max. 2·2 mm.; antennæ 1·8 mm.; palpi 1·9 mm.; pedes I 3·2; II 2·8; III 2·9; IV 3·3 mm.

Patria: Africa centralis occidentalis, "France équatoriale."

Specimen unicum vidimus, ad Ogové captum, in collectione ill. E. Simon (Lutetiae Parisiorum) asservatum, nobis benevolentissime accommodatum.

Subfamilia II: Sironini.

4. PETTALUS Thor.

1876. *Pettalus* Thorell ('Ann. d. Mus. civ. d. stor. nat. d. Genova', vol. VIII., p. 469).

1897. *Pettalus* Pocock ('Ann. Nat. Hist.', Ser. 6, vol. xix., p. 288).

Cephalothorax ante, supra basin antennarum, in limbum collarem brevem libratum productus, ipsam basin antennarum anguste amplectentem; carina dorsalis transversa antennarum plane detecta. Carina dorsalis media anterior et excavationes laterales cephalothoracis evanidae.

Segmentum ventrale nonum in medio angustum, ad latera versus sensim latius, ibique a ventrali octavo bene definitum, dorsuali nono ubique libero multo minus.

Oculi nulli.

Coni fetidi breves, rotundati, partem non dimidiam globi formantes, subæque late a margine laterali scuti dorsalis atque a linea media corporis remoti, sursum et nonnihil extorsum directi; quasi quodam nodulo apicali instructi.

Antennarum articulus primus ante leviter, pone aliquantum compressus, secundum margines inferiores ante angulatus, tuberculis inferioribus duobus et carina exteriore solitis præditus. Dentes utriusque rami forcipis valde inaequales; dentes longi nonnulli et dentes breviores plures irregulariter alternantes.

Palporum pars trochanterica inermis, fere clavata, parte femorali paullo gracilior et multo brevior; pars femoralis vix compressa, gracilis; pars tarsalis brevior quam tibialis.

Coxa I ante non producta; spatium inter angulum anteriorem coxae et angulum anteriorem, sat manifestum, carinæ stomothecam limitantis perpaullo brevius aut perpaullo longius quam carina stomothecae. Paries stomothecae ad medium minus latus, ad basin et apicem versus sensim angustior, ubique oblique descendens. Stomotheca sat angusta manifesto longior quam latior. Coxæ I pone late inter se remotæ; pars mollis lobi maxillaris in partes duas divisa, parte posteriore magna lobo maxillari coxae II contigua, parte anteriore manifesta, a pariete duro coxae (stomothecae) bene limitata.

Lobi maxillares coxarum II partem anteriorem circiter dimidiam basis coxarum explentes, extra medium suum multo latiores quam intra; margo anterior lobi aliquantum convexus, vix autem angulatus.

Coxa I nonnihil latior quam II, vix latior quam III, plus duplo angustior quam IV, quæ per magna est.

Sternum minutum adest.

Metatarsi circiter duplo breviores quam tarsi.

Solea tarsi I, infra valde incrassati, insignis, partem ulteriorem minorem explens, a parte citeriore manifesto limitatam.

Tarsi I et II supra per longitudinem non sulcati.

Unguiculi simplices (neque denticulati); IV duplo longior quam I.

Differentia sexualis præter structuram tarsi IV et formam et positionem aperturæ genitalis verisimiliter forma partis postremæ abdominis demonstratur. (Adhuc mares, adulti et juniores, non autem feminæ, cogniti sunt.)

Species duæ adhuc cognitæ mediocres vel majores, Indiæ orientalis (insulæ Taprobanes—quam nunc "Ceylon" vocamus) indigenæ.

Conspectus specierum.

1. Segmenta abdominalia dorsalia priora sex tantum granulis minutis densissimis ornata. Tarsus I duplo et dimidio longior quam crassior; solea perpaullo brevior quam pars dimidia lateris inferioris articuli *P. cimiciformis* Cambr.
2. Segmenta abdominalia dorsalia priora sex præter granula subtilissima densissima impressionibus et elevationibus minoribus, valde irregularibus ornata, quare superficiem quasi cicatricosam præbent. Tarsus I triplo longior quam crassior; solea $\frac{2}{3}$ lateris inferioris tarsi explens *P. brevicauda* Poc.

1. *Pettalus cimiciformis* Cambr.

Tab. III., figg. 2 a—2 i.

Mas 3·5 mm. longus, fulvescente-succineus; segmenta abdominalia dorsalia priora sex tantum granulis minutis ornata; pars lateralis segmenti thoracici non discreta; articulus primus antennarum tubculo exteriore fere evanido, articulus secundus plus quam sextuplo longior quam latior, articulus tertius articulo secundo vix quadruplo brevior; carinae stomothecae perpaullo longiores quam spatium inter angulum anteriorem carinæ et angulum anteriorem coxae positum; tarsus I duplo et dimidio

longior quam crassior, solea perpaullo brevior quam pars dimidia lateris inferioris.—Margo lateralis abdominis incisuras latas levesque sex ostendit; segmentum dorsuale septimum pone fortiter emarginatum elevationibus non ornatum.

1875. *Cyphophthalmus cimiciformis* O. P. Cambridge ('Ann. Nat. Hist.', Ser. 4, vol. xvi., p. 383; Tab. XIII., fig. 3).

Corpus alte fornicatum, ante conos fœtidos subito rotundate declive, aequo latum in cephalothorace atque in abdomen. Dorsum cephalothoracis et segmentorum abdominalium priorum sex granulis densissimis subæqualibus ornatum; segmenta septimum granulis minoribus et octavum granulis parvulis pilisque prædicta. Coxæ et venter granulis ornata, ante majoribus et sat densis, pone sensim minoribus et densioribus, ita ut segmenta septimum et octavum granulis parvulis densissimis ornata sint. Palpi vix coriacei. Pedes densissime subtiliter granulati.

Cephalothorax sulco, in medio leviter arcuato, limitatus. Sulcus posterior debilis, in medio obsoletus. Pars lateralis segmenti thoracici vix expressi non discreta.

Coni fœtidí supra inspecti plus duplo breviores quam ad basin latores; in apice rotundati, infra apicem levissime impressi. Nodus apicalis haud magnus.

Ventris sulci laterales, post spiracula positi, leviter obliqui, impressione levi lata inter se conjuncti. Venter totus æqualiter convexus. Sulci transversi priores tres extra impressiones musculares antrorum non arcuati. Operculum anale leviter convexum, dimidio latius quam longius. Segmentum dorsuale nonum (saltem in mare) in medio vix vel non brevius quam ventrale octavum.

Antennarum articulus primus quadruplo longior quam ad basin latior, manifesto angustior quam conus fœtidus, ubique densissime granulatus; tuberculum inferius exterius perminutum, fere evanidum, ante apicem coxae I positum; tuberculum inferius basale altum. Articuli secundi pars citerior articulo primo manifesto gracilior et vix dimidio longior, plus quam sextuplo longior quam latior, levigatus, nitidus. Articulus tertius parte citeriore articuli secundi vix quadruplo brevior.

Carinæ stomothecæ perpaullo longiores quam spatium, inter apicem carinæ et apicem anteriorem coxae positum.

Pedes breviores sat robusti. Femora I deorsum vix curvatum, cetera recta. Tibiae desuper inspectæ patellis parte circiter tertia longiores; III paullo plus duplo, IV pene triplo longiores quam crassiores. Tarsi (ubi crassissimi) tibiis I manifesto crassior, II et III manifesto tenuiores. Tarsus I infra valde incrassatus, vix duplo et dimidio longior quam crassior; solea partem ulteriorem vix dimidiata excipit.

Differentia sexualis: Femina incognita. Maris: Segmenta dorsalia septimum pone fortiter emarginatum (sive in lateribus multo longius quam in medio); octavum (et limbus posterior septimi) supra sat profunde excavatum, pone in processus duos, subæque longos atque ipsum segmentum, latores quam longiores, productum, leviter oblique depresso, supra in parte ulteriore tumidos; lateribus incisure, duplo longioris quam pone latioris, pili impositi sunt, trans incisuram fere attingentes. Scutum dorsuale ventrem amplectens, in lateribus marginatum; margo incisuras latas leves sex ostendit.—Tarsus IV prope basin manifesto latior et crassior, paullo gracilior quam tibia. Eminentia dorsalis tarsi IV subbasalis interior, oblique posita; pars basalis robusta compressa, humilior quam ad basin longior; pars apicalis ex angulo anteriore partis basalis oriens, paullulo longior quam pars basalis, subulata, extrorsum et deorsum subito et fortiter curvata.—Operculum genitale per breve, ante leviter emarginatum, et quasi limbus aperturæ, mediocris et paullulo longioris quam latioris, sulco levi limitatus appareat. Arculi genitales perlongi, margine exteriore aliquantum concavo; secundum aperturam genitalem et ad lineam medianam corporis (ubi sese attingunt) costa subtili ornata; carinis singulis humilibus et rotundatis prædicti, in angulum suum obtusum parvum, nonnihil ante aperturam genitalem positum, leviter productis.

Fulvescente-succineus, unicolor.

Long. corp. 3·6 mm.; long. cephalothor. 1·7 mm.; lat. max. 2·1 mm.; antennæ 2·1 mm.; palpi 2·2 mm.; pedes I 3·7; II 3·1; III 3; IV 3·7 mm.

Patria: Taprobane. Specimen unicum, typicum ab ill. O. P. Cambridge descriptum, perlustravimus, quod ill. auctor nobis benevolentissime accommodavit.

2. *Pettalus brevicauda* Poc.

Tab. III., figg. 3a—3g.

Mas 4·6 mm. longus, rubicundo-succineus; segmenta abdominalia dorsalia priora sex præter granula subtilissima densissima impressionibus et elevationibus minoribus valde irregularibus ornata, quare superficiem quasi cicatricosam præbent; pars lateralis segmenti thoraciei manifesto discreta; articulus primus antennarum tuberculo exteriore manifesto, articulus secundus circiter sextuplo longior quam latior, articulus tertius articulo secundo triplo et dimidio brevior; carinæ stomothecæ perpaullo breviores quam spatium, inter angulum anteriorem carinæ et angulum anteriorem coxae positum; tarsus I triplo longior quam crassior, soleara $\frac{2}{3}$ lateris inferioris tarsi explens.—Margo lateralis abdominis incisuras angustas leves quattuor ostendit; segmenta dorsalia sextum et septimum pone minus fortiter emarginata, septimum elevationibus levibus duabus ornatum.

1897. *Pettalus brevicauda* Pocock, Mas immaturus et mas jun. ("Ann. Nat. Hist.", Ser. 6, vol. xix., p. 289).

Corpus ante alte fornicatum, ante conos fætidos subito rotundate declive, manifesto latius in segmento abdominali tertio quam in cephalothorace. Dorsum cephalothoracis granis, pone minoribus, densis (non autem contiguis) præditum; limbus collaris et area transversa brevior, post limbum collarem posita, lèves. Dorsum abdominis densissime et subtilissime granulatum et impressionibus et elevationibus minoribus irregularibus ornatum, quibus superficies quasi cicatrica appareat; granula segmenti octavi parce dispersa. Coxæ granulis sat magnis parce ornatae; grana ventris ante sat magna et sat densa, pone sensim minora et densiora. Pedes densissime subtiliter granulati.

Cephalothorax sulco, in medio arcuato, limitatus. Sulcus posterior debilis, in medio obsoletus. Pars lateralis segmenti thoracici manifesto discreta.

Coni fætidi supra inspecti plus duplo breviores quam ad basin latiores, apice rotundato; subtilissime et densissime granulati, parte laterali exteriore basali, ovate lentiformi, tamen lèvi. Nodus apicalis parvus.

Ventris sulci laterales, post spiracula positi, leviter obliqui, impressione levi perlata inter se conjuncti. Venter totus leviter et æqualiter convexus. Sulci transversi priores tres extra impressiones musculares antrorum non arcuati. Operculum anale dimidio latius quam longius. Segmentum dorsuale nonum in medio paullo brevius quam ventrale octavum.

Antennarum articulus primus quadruplo longior quam ad basin latior, manifesto angustior quam conus fætidus, ubique densissime granulatus; tuberculum inferius exterus manifestum, pone apicem coxae I positum. Articuli secundi pars ceterior articulo primo gracilior et pene dimidio longior, circiter sextuplo longior quam latior; lèvis nitidus. Articulus tertius parte ceteriore articuli secundi triplo et dimidio brevior.

Carinæ stomothecæ paullo breviores quam spatium, inter apicem carinæ et apicem anteriorem coxae positum.

Pedes breviores, minus graciles. Femora I deorsum leviter curvatum, cetera recta. Tibiae desuper inspectæ patellis vix parte tertia breviores; III paullo ultra duplo et dimidio, IV triplo longiores quam crassiores. Tarsi tibiis I manifesto crassior, II et III manifesto tenuiores. Tarsus I duplo et dimidio longior quam crassior; soleara $\frac{2}{3}$ longitudinis articuli explens.

Differentia sexualis: Femina incognita. *Maris* segmenta dorsalia sextum et septimum pone minus fortiter emarginata; septimum elevationibus levibus duabus præditum; octavum (et limbus posterior septimi) supra excavatum, pone in processus duos, longiores quam ipsum segmentum, productum, æque longos atque latos, supra fere totos intumescentes (basi tantum depressa); lateribus incisuræ, fere triplo longioris quam pone latioris, pili impositi sunt (in ordines binos positi), quorum superiores saltem ultimi sese trans incisuram attingunt. Margo lateralis scuti dorsualis incisuras leves angustas quattuor vel tres (nam prima perlevis est) ostendit.—Eminentia dorsualis tarsi IV subbasalis, interior, oblique posita (fere transversa); pars basalis robusta compressa, ad basin fere duplo longior quam altior; pars apicalis ex angulo producto anteriore partis basalis oriens, duplo longior quam pars basalis, subulata, extrorsum et deorsum fortiter curvata.—

Operculum genitale breve, ante leviter emarginatum, quasi limbus angustissimus aperturæ medioeris latioris quam longioris appareat, sulco levissimo limitatus. Areuli genitales perlongi, margine exteriore paulum convexo, secundum aperturam genitalem costa levi et ad lineam medianam corporis (ubi sese attingunt) costa subtilissima ornati; carinis singulis sat altis, granulis crenulatis, prædicti, in angulum suum, aliquantum ante aperturam genitalem positum, productis.

Fulvescente-succineus, dorso (num etiam vivi animalis?) fuscescente; digitæ antennarum rubescentes.

Long. corp. 5·2 (sine processibus posterioribus: 4·6) mm.; long. cephalothor. 2·2 mm.; lat. max. 2·9 mm.; antennæ 3·2 mm.; palpi 3·4 mm.; pedes I 6·3; II 5·5; III 5·5; IV 6·2 mm.

Animal adolescens 3 mm. longum, 2·1 latum. Dorsum granulis parvis, posteriora versus paulo minoribus, ubique ornatum; tantum limbus collaris lœvis; dorsum non cicatricosum. Segmenta abdominalia dorsalia inter se et cum cephalothorace coalita; cetera libera esse *videntur*; priora sex linea impressa media ornata; primum impressionibus duabus, lateralibus, magnis, rotundis; sextum pone fere sub angulo emarginatum; octavum pone levissime emarginatum. Elevationes areculorum genitalium jam magnæ.

Patria: Taprobane. Exempla duo perlustravimus, marem adultum et marem juniorem (specimen minus ab ill. Pocock descriptum), ad Punduloya a cl. E. E. Green collecta, in Museo Britannico asservata.

5. PURCELLIA n. g.

Cephalothorax ante, supra basin antennarum, breviter productus; pars producta basin antennarum anguste amplectens, carinam dorsualem transversam antennarum attingens. Pars anterior cephalothoracis carinam latam dorsualem, in triangulum anteriorem dilatatam, pone evanidam, demonstrat. Segmentum ventrale nonum saltem ad latera versus a ventrali octavo bene limitatum, in femina nonnihilo, in mare multo, minus quam dorsuale nonum; hoc segmentum ubique liberum (in mare permagnum).

Oculi nulli.

Coni fœtidi breves, rotundati, partem non dimidiā globi formantes, a margine laterali cephalothoracis spatio remoti, quod diametro basali coni pâne duplo longius est; sursum et paullum extrosrum directi; quasi quodam nodulo apicali parvo instructi.

Antennarum articulus primus ante leviter, pone aliquantum compressus, secundum margines inferiores, præsertim exteriorem, angulatus, tuberculis inferioribus, exteriore magno et basali minuto, et carina exteriore solitis prædictis. Dentes rami fixi forcipis subsimiles, compressi et bicuspidati; dentes partis citerioris rami mobilis minuti, rotundati, partis ulterioris majores ex parte lati et alti et bicuspidati.

Palporum pars trochanterica curvata, fusiforme-clavata, ad apicem versus dilatata, processiculo inferiore, ultra medium posito, armata, parte femorali paulo crassior et multo brevir; pars femoralis vix compressa, gracilis; pars tarsalis brevior quam tibialis.

Coxæ I ante vix productæ; spatium, inter angulum anteriorem coxæ et angulum subevanidum carinæ stomothecam limitantis positum, paulo longius quam spatium inter basin coxæ et angulum carinæ dictæ positum. Paries stomothecæ sat latus, a basi antrorum paulo latior, per longitudinem excavatus, margine anteriore curvato. Stomotheca minus lata, manifesto longior quam latior. Coxæ pone inter se late remotæ. Pars mollis lobi maxillaris in partes duas divisa; pars posterior sat magna, lobo maxillari coxæ II contigua; pars anterior angusta, a parte dura vix discreta.

Lobi maxillares coxarum II partem anteriorem circiter dimidiā partis basalis coxæ explentes, ad medium multo latiores quam ad lineam medianam corporis; margo anterior valde arcuatus, subangulatus.

Coxæ I nonnihilo latiores quam II, vix latiores quam III, pâne duplo angustiores quam IV.

Sternum minutum adest.

Metatarsi non duplo, sed plus quam parte sua dimidia, breviores quam tarsi.

Solea tarso I, infra paullum incrassato, deest.

Tarsi I et II supra per longitudinem non sulcati.

Unguiculi inermes; unguiculus IV circiter duabus tertii partibus longior quam I.

Differentia sexualis præter aperturam genitalem et eminentiam dorsualem tarsi IV structura partium posteriorum abdominis et numero articulorum tarsi IV (in mare duorum, in femina unius) demonstratur.

Species adhuc unica sat parva, Africæ meridionalis indigena.

Purcellia illustrans n. sp.

Tab. III., figg. 4 a—4 c; Tab. IV., figg. 1 a—1 v.

2.7—3.1 mm. longa, non duplo longior quam latior, castanea, palpis pedibusque ferrugineo-fulvis; dorsum sat dense granulatum; excavations anteriores ante plicatae; coni fœtidi circiter triplo humiliores quam latiores; antennarum articulus secundus triplo et dimidio longior quam latior, articulo tertio perpaullo plus quam duplo brevior; stomotheca paullo longior quam ante latior.—In mare: pars apicalis eminentiae dorsualis tarsi IV, fere subulata, retro curvata et leviter biarcuata; segmentum dorsuale nonum permagnum, circiter duplo et tertia parte latius quam longius, late et sat profunde excavatum, carina media levi instructum; operculum anale subtriangulum, late et profunde excavatum, carinis lateralibus altis, setis incurvis præditis, et carina levi media posteriore instructum; segmenta ventralia posteriora fortiter recurva.

Corpus producte subovale, post sulcum thoracicum sensim latius, deinde leviter angustius. Dorsum totum sat dense granulatum; granula ad posteriora versus sensim minora, ita ut in cephalothorace sat magna sint, in segmento abdominali octavo parva. (Pili parvi non, nisi sub microscopo, manifesti.) Coxæ et segmenta ventralia densissime granulata; granula granulis dorsi minora. Pedes coriacei, sat dense breviter pilosi.

Cephalothorax sulco, in medio sat procurvo, limitatus. Carina dorsualis pone lata, haud bene expressa; pars anterior triangula leviter concava, brevis, circiter duplo latior quam longior. Sulci posterioris fortiter arcuati pars media obsoleta. Excavations anteriores laterales ante transversim manifesto plicatae.

Coni fœtidi humiles, circiter triplo humiliores quam diametrum basalis.

Ventris sulci laterales obliqui longe post coxas IV desinunt. (Partes ceteræ ventris sub "differentia sexuali" memoratae.)

Antennarum sat robustarum articulus primus desuper inspectus triplo longior quam ad basin latior, supra convexus et subtiliter granulatus; tuberculum inferius exterius proxime pone apicem coxae I positum, compressum, longum et sat altum. Pars ceterior articuli secundi vix dimidio longior quam articulus primus, triplo et dimidio longior quam latior, extra plana, ceterum leviter fusiformis, laevis, nitida. Articulus tertius perpaullo plus duplo brevior quam pars ceterior articuli secundi.

Palpi antennis paullo longiores.

Stomotheca paullo longior quam ante latior.

Pedes sat graciles. Facies inferior coxae I æque alta atque ea coxae II. Femora I vix curvatum; cetera recta. Tibiae desuper inspectæ circiter quarta parte longiores quam patellæ; III fere duplo longior quam crassior. Tarsi (ubi crassissimi) tibiis: I manifesto crassior, II et III manifesto tenuiores.

Differentia sexualis: Femina mare manifesto major et relative longior et angustior. Tibia IV feminæ duplo et dimidio, maris duplo longior quam crassior. Tarsus IV feminæ manifesto tenuior quam tibia, maris æque crassus atque ea. Articulus primus tarsi IV maris valde incrassatus, æque crassus atque longus; pars basalis eminentiae dorsualis, ab ipso articulo haud bene limitata, ad latus interius versus posita, obliqua; pars apicalis fere subulata, retrorsum et leviter extorsum curvata, leviter biarcuata, marginem posteriorem articuli attingens.—Sulci, segmenta dorsalia sextum et septimum et octavum separantes, in femina manifesti et recti; sulcus, segmenta sextum et septimum separans, in mare leviter bisinuatus et ad latera versus evanidus; sulcus insequens apud mare in medio obsoletus et ad latera versus evanidus. Margo posterior segmenti dorsualis octavi in femina finem posteriorem corporis fere efficit, in mare autem sat longe ante finem posteriorem corporis, in latere inferiore positus est; pars inferior (vel potius inflexa) et posterior hujus segmenti apud mare in medio leviter excavata. Segmentum dorsuale nonum feminæ brevissimum, circiter decuplo latius quam longius, maris autem circiter duplo et tertia parte latius quam longius, lateraliter carinatum, late et sat profunde excavatum, carinam

levem, per longitudinem ductam, in fundo excavationis præbens. Operculum anale feminæ suborbiculare (parte tertia tamen latius quam longius) convexum; maris subtriangulum, lateribus curvatis, æque longum atque latum, lateraliter alte carinatum, in medio profunde excavatum, carinam levem posteriorem, per longitudinem ductam, in fundo excavationis præbens; carinae laterales ordinibus singulis setarum densarum incurvarum ornatae, sese trans excavationem fere attingentium. Ob magnitudinem et structuram segmentorum dorsualium analis et paenultimi sulci ventrales, segmenta sextum et septimum et octavum separantes, in femina leviter, in mare fortiter recurvi.—*Maris* operculum genitale per breve, sutura posteriore non limitatum (quasi limbus aperturae parvæ, sulco levi limitatus, videtur), ante leviter emarginatum; areuli genitales latissimi, ante aperturam elevatione sua levi prædicti. *Feminæ* operculum genitale dense granulatum, pone vix limitatum, brevius quam ad basin latius, sensim angustius. Areuli genitales juxta operculum altius quam hoc elevati, in angulum suum, brevem, rotundatum, oblique deorsum prominentem, haud procul ante operculum elevati.

Color: Corpus et antennæ nitidæ castaneæ. Palpi et pedes ferrugineo-fulvi, apicem versus paullo dilutiores.

Long. corp. ♂ 2·7, ♀ 3·1 mm.; lat. max. ♂ 1·6, ♀ 1·65 mm.; long. cephalothor. ♂ 1·25, ♀ 1·4 mm.; antennæ ♂ ♀ 1·8 mm.; palpi ♂ 2·1, ♀ 1·85 mm.; pedes I ♂ ♀ 3; II ♂ 2·6, ♀ 2·7; III ♂ 2·2, ♀ 2·5; IV ♂ 2·8, ♀ 2·9 mm.

Animalia juniora imprimis hisce in rebus ab adultis differunt:

2·2 mm. longum, 1·5 latum, itaque relative latius quam adultum.

Segmenta abdominalia dorsalia tertium, quartum, quintum, sextum in linea media corporis divisa; posteriora septem libera, quum priora duo secum et cum cephalothorace coalita sint.

Segmenta abdominalia ventralia sextum, septimum, octavum libera; quintum cum sexto in parte media cute molli conjunctum, lateraliter autem coalitum; secundum (spiracula gerens) a tertio stria curvata cutis mollis separatum.

Tarsus IV maris articulo unico formatus, ante medium dorsi leviter tumidus, eminentia destitutus.

Brunneum vel brunneo-testaceum, antennis fulvis, membris ceteris testaceis.

Patria: Caput Bonæ Spei. Exempla adulta octo, mares quattuor et feminas quattuor, et juniores mares quattuor et feminas septem et animal juvenile unum perlustravimus, quæ cl. Dr. Fr. Purcell in monte "Table Mountain" appellato collegit et nobis partim accommodavit, partim dedit.

6. SIRO Latr.

- 1797. Siro Latr. ('Précis des Caractères gén. des Insectes', p. 185).
- 1806. Siro Latr. ('Genera Crust. et Ins.', T. I, p. 142).
- 1868. Cyphophthalmus Joseph ('Berlin. Ent. Zeitschr.', XII., pp. 241—250, 269—272).
- 1872. Cyphophthalmus E. Simon ('Ann. Soc. Ent. France', Sér. 5, II., p. 239).
- 1876. Cyphophthalmus Thorell ('Ann. Mus. civ. stor. nat. Genova', vol. VIII., p. 469).
- 1879. Siro E. Simon ('Arachnides de France', VII., p. 144).

Cephalothorax ante non productus. Carina dorsalis media anterior evanida; excavationes anteriores laterales leves vel evanidæ.

Segmentum ventrale nonum ad lineam medianam corporis brevissimum, ad latera versus sat breve, cum octavo confluens et ab eo haud conspicue limitatum, aliquanto minus quam dorsuale nonum, quod cum segmentis ventralibus octavo et nono coalitum et ab iis haud conspicue limitatum est.

Oculi nulli.

Coni fœtidi magnitudine mediocres, a margine laterali cephalothoracis spatio remoti, quod diametro coni paullo vel vix brevius est, quasi quodam nodulo apicali sat magno instructi.

Antennarum artculus primus leviter compressus, secundum margines inferiores ante leviter angulatus, tuberculo basali destitutus. Dentes utriusque rami forcipis inter se subsimiles; dentes rami mobilis nonnihilo minores et magis rotundati quam dentes rami fixi.

Palporum pars trochanterica subclavata, in sua parte citeriore sat curvata, inermis, parte femorali per paullo crassior et multo brevior. Pars femoralis vix compressa, gracilis. Pars tarsalis parte tibiali brevior.

Coxæ I ante non productæ; spatium, inter angulum anteriorem coxæ et angulum anteriorem prominentem carina stomothecam limitantis positum, saltem plus duplo et dimidio brevius quam carina stomothece. Stomotheca permagna, pæne æque lata atque longa. Paries durus stomothece perlatus, antrorsum paulo latior, per longitudinem excavatus, margine anteriore longo, obliquo, curvato. Coxæ pone contiguae, quare partes molles loborum maxillarium a coxis II remoti sunt. Pars mollis lobi maxillaris in partes duas divisa; pars posterior parva; pars anterior augustissima vix manifesta.

Lobi maxillares coxarum II magni vel permagni, saltem partem majorem basis coxæ explentes, extorsum saltem non latiores, margine anteriore subrecto.

Coxæ I multo latiores quam II, nonnihilo latiores quam III, nonnihilo angustiores quam IV.

Sternum nullum.

Metatarsi plus duplo breviores quam tarsi.

Tarsus I infra paullum incrassatus, solea destitutus.

Tarsi I et II supra per longitudinem non sulcati.

Unguiculi inermes; IV pæne duplo longior quam I.

Differentia sexualis præter aperturam genitalem et eminentiam dorsualem tarsi IV structura operculi analis demonstratur.

Species (duæ) adhuc cognitæ minutæ, Austriae et Galliæ indigenæ.

Conspectus specierum.

1. Abdomen pone late truncatum; coni foetidi multo breviores quam ad basin latiores; tuberculum inferius et exterius articuli primi antennarum sat altum et extorsum leviter directum, itaque manifestum *S. rubens* Latr.
2. Abdomen pone haud manifesto truncatum; coni foetidi vix breviores quam latiores; tuberculum inferius et exterius articuli primi antennarum humile, rotundatum, itaque vix manifestum *S. duricorius* Jos.

1. *Siro rubens* Latr.

Tab. IV., figg. 2a—2d'.

Mas 1·7 mm. longus, non duplo longior quam latior, rufo-fuscus, ante saturatior, antennis et pedibus testaceis; abdomen pone late truncatum; coni foetidi multo breviores quam ad basin latiores, breviter conici, apice rotundato; articulus primus antennarum haud quadruplo longior quam latior, tuberculo inferiore et exteriore sat alto et extorsum leviter directo, itaque manifesto; articulus secundus haud triplo et dimidio longior quam latior; articulus tertius articulo secundo duplo brevior; tibia IV non duplo longior quam crassior.—Eminentia dorsuialis tarsi IV maris proxime citra medium articuli posita; pars basalis reclinis, compressa, oblique truncata, altior quam ad basin longior; pars apicalis brevior, setiformis margini posteriori partis basalis imposita.

1804. *Siro rubens* Latr. ('Hist. nat. gén. et part. Crust. et Ins.', T. VII., p. 329).

1806. *Siro rubens* Latr. ('Genera Crust. et Insect.', T. I., p. 143, Tab. VI., Fig. 2).

1879. *Siro rubens* E. Simon ('Les Arachnides de France', T. VII., p. 145, Tab. XXII., Figg. 12—14).

Corpus non duplo longius quam latius, pone late truncatum; dorsum in medio subplanum, in lateribus autem abrupte rotundate declive; granulis densis supra ornatum, quæ in cephalothorace vix majora vixque minus densa sunt. Venter granulis minoribus densis praeditus; pedes coriaceti. Dorsum imprimis pone parce pilosum.

Cephalothorax ante conos foetidos vix excavatus, sulco transverso, manifeste bisinuato, limitatus, cuius pars media leviter procura est. Sulcus posterior debilis, quare oculos facile effugit.

Coni foetidi extorsum et leviter sursum directi, a margine laterali cephalothoracis spatio remoti, quod diametro basali coni vix minus est; breviter conici, multo breviores quam ad basin latiores.

Venter in medio subplanus. Sulci obliqui fere semicirculariter circum spiracula curvati, coxas IV attingentes. Sulci transversi subrecti; primus tamen extra impressiones musculares antrorum leviter directus.

Antennarum artculus primus haud quadruplo longior quam ad basin latior, ad basin paullo angustior quam conus fætidus, supra densissime granulatus; carina dorsualis subbasalis transversa debilis, rotundata (oculum itaque facile effugiens); tuberculum inferius et exterius sat altum, non acutum, extrorsum leviter directum, itaque manifestum. Articuli secundi pars citerior æque longa atque artculus primus, haud triplo et dimidio longior quam latior, levis. Articulus tertius duplo brevior quam pars citerior articuli secundi.

Lobi maxillares coxarum II permagni, marginem posteriorem coxae attingentes, ubi nonnihilo angustiores sunt quam ad marginem anteriorem coxae.

Pedes pubescentes, fere ut in specie sequente. Femora recta. Tibiae desuper inspectæ I non tertia parte, II circiter quarta parte, III et IV perpaulli longiores quam patellæ. Tarsi (ubi crassissimi) tibiis: I manifesto, II vix crassiores, III tenuior.

Differentia sexualis. Femina incognita.—*Maris* tarsus IV manifesto crassior quam tibia, in dorso medio enim manifesto incrassatus. Eminentia dorsualis tarsi IV proxime citra medium posita; pars basalis altior quam ad basin longior, compressa, leviter retrorsum et levissime extrorsum directa, oblique truncata; pars apicalis setiformis parte basali manifesto brevior (non crassior quam pili longiores tarsi), angulo marginis posterioris incurvi partis basalis imposita, leviter flexuosa.—Operculum anale fere ut in specie sequente formatum.—Operculum genitale pone vix limitatum, brevissimum, granulatum, margine anteriore subrecto. Arculi genitales a coxis IV vix manifesto limitati, perlati; pars major posterior et lateralis granulata, leviter convexa, secundum margines aperturae genitalis costa predita, quæ proxime post apicem aperturae nodo elevato instructa est; pars anterior arcularum in costam medianam latam et sat altam, ante valde dilatatam et cum costa altera confluentem, elevata.

Rufo-fulvus, in parte anteriore cephalothoracis paullo saturatior. Antennæ et pedes fulvo-testacei. Palpi testacei.

Long. corp. 1·7 mm.; long. cephalothor. 0·76 mm.; lat. max. 0·97 mm.; antennæ 1·12 mm.; palpi 1·3 mm.; pedes I 1·85; II 1·68; III 1·4; IV 1·7 mm.

Patria: Gallia centralis et meridionalis; ad radices arborum, sub muscis, sub lapidibus secundum Latreille vivens. Specimen unicum, marem, vidimus, ab ill. E. Simon descriptum et nobis benevolentissime accommodatum.

2. *Siro duricorius* Joseph.

Tab. IV., figg. 3a—3b; Tab. V., figg. 1a—1o.

Circiter 2 mm. longus, non duplo longior quam latior, castaneus, pedibus fulvis; abdomen pone haud manifesto truncatum; coni fætidi vix breviores quam ad basin latiores, apicem rotundatum versus multo angustiores; artculus primus antennarum paullo plus triplo longior quam ad basin latior, tuberculo inferiore et exteriore humili, ubique late rotundato; artculus secundus circiter triplo longior quam latior; artculus tertius articulo secundo duplo brevior; tibiae I patella quarta parte longior, IV circiter duplo longior quam crassior.—Eminentia dorsualis tarsi IV maris ad apicem partis proximæ tertiae articuli posita; pars basalis ab ipso articulo vix limitata; pars apicalis multo longior, subulata.

1868. *Cyphophthalmus duricorius* G. Joseph ♀ ('Berlin. Entom. Zeitschr.', XII, pp. 241—250, Tab. I., Figg. 1—12).

1868. *Cyphophthalmus duricorius* p.p.¹ ♀ ♂² (Ibid., XII, pp. 269—272, Tab. I., Figg. 13—14, 16—17).

1879. *Siro duricorius* E. Simon ('Les Arachnides de France', T. VII., p. 146).

1882. *Siro duricorius* G. Joseph ('Berlin. Ent. Zeitschr.', XXVI., p. 20).

1896. *Siro duricorius* Hamann ('Europäische Höhlenfauna', p. 215).

Corpus non duplo longius quam latius, producte ellipticum, pone haud manifesto truncatum; supra granis densis ornatum, quorum anteriora perpaulli majora sunt; venter et coxae granis parvis

¹ Teste ipso auctore: inspiciantur, quæ de *Sirone cyphophthalmus* infra dicta sunt.

² Nam ill. Joseph p. 270 dicit: "Die Form der Geschlechtsöffnung ist bald dreieckig, bald quer oval. Ob dies

Geschlechtsunterschied ist, wage ich nicht zu bestimmen." Feminae autem sunt animalcula, quæ auctor "Männchen" nominat; nam "die sehr lange Ruthe," in figura 17 delineata, est ovipositor feminæ, neque penis maris.

densis; pedes granulati vel coriacei. Dorsum pilis brevibus pallidis parce ornatum, qui in segmentis posterioribus longiores et manifesti sunt.

Cephalothorax ante conos fœtidos in lateribus leviter excavatus, sulco bisinuato limitatus, ejus pars media manifesto procura est. Sulcus posterior manifestus.

Coni fœtidi a margine laterali cephalothoracis spatio remoti, quod diametro basali coni paullo minus est, leviter proclives, vix breviores quam ad basin latiores, apicem rotundatum versus multo angustiores, coriacei. Nodus apicalis sat magnus, fortiter convexus, nitidus, itaque oculum magnopere simulans.

Venter convexus. Sulci "obliqui" transversi, aliquantum a medio subito adversus aperturam genitalem directi, neque marginem lateralem corporis neque aperturam attingentes. Sulci transverse subrecti.

Antennarum articulus primus paullo plus duplo longior quam ad basin latior, ad basin vix latior quam conus fœtidus, supra et partim infra dense granulatus; carina dorsualis transversa subbasalis evanida; tuberculum inferius et exterior humile, ubique late rotundatum, vix manifestum, proxime post apicem coxae I positum. Articuli secundi pars ceterior paullo longior quam articulus primus, circiter triplo longior quam latior; intra plana, ceterum perverse subovata. Articulus tertius parte ceteriore articuli secundi duplo brevior.

Lobi maxillares coxarum II minores quam in specie præcedente, marginem posteriorem coxae attingentes, ubi circiter duplo breviores quam ad marginem anteriorem coxae.

Pedes leviter pubescentes, metatarsi et tarsi sat dense. Femora I deorsum vix curvatum, cetera recta. Tibiae desuper inspectæ I circiter quarta parte, ceteræ per paullo vel vix longiores quam patellæ; III non duplo, IV circiter duplo longiores quam crassiores. Tarsi, ubi crassissimi, tibiis: I paullo crassior, II vix, III manifesto tenuiores.

Differentia sexualis: Femina paullulo major et relative angustior quam mas. Tarsus IV utriusque sexus tenuior quam tibia; maris prope basin paullo, tamen manifesto, latior et crassior. Eminentia dorsualis tarsi IV (maris) ad apicem partis proximæ tertiae articuli posita; pars basalis ab ipso articulo vix limitata; pars apicalis multo longior et apice partis basalis multo tenuior, subulata, retrorsum directa et leviter curvata. Operculum anale feminae sat convexum manifesto latius quam longius; maris vix convexum, vix latius quam longius, carina humili, lata, rotundata, laevi, pone latiore, per longitudinem ducta, ornatum.—Operculum genitale pone non limitatum, margine anteriore recto, in mare brevissimum, in femina linea curvata impressa, post marginem posita, ornatum. Apertura genitalis maris aliquanto latior quam longior, feminæ subæque longa atque lata. Arculi genitales maris a coxis IV haud bene limitati, perlati; partes posterior et lateral is levissime convexæ, secundum marginem aperturæ haud costatae; ad lineam medianam corporis, ubi arculi sese attingunt, costa sat alta ornati et nodo sat magno, prope marginem anteriorem posito, prædicti. Arculi feminae secundum operculum convexi, in angulum suum obtusum, ante apicem operculi positum, producti, secundum marginem anteriorem costa prædicti.

Castaneus. Antennæ castaneæ; membra cetera fulva.

Long. corp. ♂ 1.95, ♀ 2.1 mm.; long. cephalothor. ♂ 0.92, ♀ 1.25 mm.; lat. max. ♂ 1.16, ♀ 1 mm.; antennæ ♂ 1.25, ♀ 1.3 mm.; palpi ♂ 1.35, ♀ 1.4 mm.; pedes I ♂ 2.06, ♀ 2.2; II ♂ 1.7, ♀ 1.8; III ♂ 1.5, ♀ 1.6; IV ♂ 1.83, ♀ 2 mm.

Patria: Austria¹; provincia Krain; intra et extra cavernas vivens.—Exempla undecim vidimus, quorum tres mares et tres feminas ill. G. Joseph, mares duos ill. E. Simon nobis dedit, duo mares in Museo aulico Vindobonensi, mas unus in Museo Hauniensi, asservantur.

7. PARASIRO n. g.

1879. Siro p. p. E. Simon ('Arachnides de France', VII., p. 144).

Cephalothorax ante non productus. Carina dorsualis media anterior fere evanida, per brevis; excavationes laterales anteriores levissimæ.

Segmentum ventrale nonum in medio angustissimum et evanidum, ad latera versus multo latius et a ventrali octavo sat manifeste limitatum, nonnihilo minus quam dorsuale nonum. Dorsuale nonum a segmentis ventralibus octavo et nono discretum, liberum.

¹ Cognovimus, aliquot specimenia speciei cuiusdam hujus generis in Hungaria collecta et in Museo Paduensi asservata esse; nescimus autem, utrum specimenia illa Sironis duricorii an sueæ speciei sint.

Oculi nulli.

Coni fœtidi longiores, margini laterali cephalothoracis subcontigui, fere librati, quasi quodam nodulo apicali magno instructi.

Antennarum articulus primus leviter compressus, secundum margines inferiores et imprimis exteriorē angulatus; tuberculum inferius et exterius sat altum, tuberculum basale deest. Dentes utriusque rami forcipis inter sese sat similes, omnes trianguli rotundati.

Palporum pars trochanterica ad apicem versus incrassata, parte citeriore leviter curvata, inermis parte femorali non crassior et multo brevior; pars femoralis vix compressa, gracilis; pars tarsalis brevior quam pars tibialis.

Coxæ I ante non productæ; spatium inter angulum anteriorem coxæ et angulum anteriorem prominentem carinæ, stomotheacam limitantis, positum saltem quintuplo brevius quam carina stomotheacam limitans. Stomotheaca permagna, paullo longior quam latior, fere omnino ut in genere Sironis formata.

Lobi maxillares coxarum II permagni saltem duas partes tertias basis coxæ explentes, a linea media corporis ad medium suum versus paullo longiores, margine anteriore leviter curvato, nodulis inferioribus binis praediti.

Coxæ I multo latiores quam II, nonnihil latiores quam III, aliquanto angustiores quam IV.

Sternum nullum.

Metatarsi paullo tantum breviores quam tarsi.

Solea tarso I infra haud incrassato deest.

Tarsi I et II supra per longitudinem non sulcati.

Unguiculi pedum omnes dentibus duobus vel tribus instructi; IV vix plus dimidio longior quam I.

Differentia sexualis apertura genitali et eminentia dorsuali tarsi IV demonstratur.

1. *Parasiro corsicus* E. Simon.

Tab. V., figg. 2a—2q.

1·8 mm. longus, castaneus, membris et conis fœtidis fulvis; sulcus thoracicus deest; coni fœtidi nonnihil longiores quam ad basin latiores, ad apicem oblique truncatum versus nonnihil angustiores; articulus primus antennarum vix triplo longior quam ad basin latior, tuberculo inferiore et exteriorē magno acuto, articulus secundus paullo plus duplo longior quam latior, citra basin digitorum processu superiore brevi late triangulo, acuto instructus, articulus tertius articulo secundo paullo plus quam dimidio brevior; tibiae I patella vix quinta parte longior, IV duplo longior quam crassior; metatarsi I et II ultra medium oblique leviter constricti, parte citeriore granulata, parte ulteriore lœvi.—Eminentia dorsalis tarsi IV maris pars basalis subconica, paullo humilior quam ad basin longior; pars apicalis fere subulata, sat longa, retro curvata.

1872. *Cyphophthalmus corsicus* E. Simon ♀ ('Ann. Soc. ent. France', Sér. 5, T. II., p. 240, Tab. XIII., Fig. 20).
1879. *Siro corsicus* E. Simon ♀ ('Arachnides de France', VII., p. 146, Tab. XXII., Figg. 9—11).

Corpus maris perpaullo plus duplo, feminae vix duplo longius quam latius, supra granis majoribus densis ornatum, quorum anteriora vix majora sunt. Venter et coxae dense granulata. Dorsum pilis pallidis præditum, qui ante breves sunt, in segmentis postremis autem longiores et manifesti. Pedes leviter pubescentes, metatarsi et tarsi sat dense.

Cephalothorax ante conos fœtidos in lateribus levissime excavatus, sulco leviter et æqualiter procurvo (neque bisinuato) limitatus. Sulcus posterior deest.

Coni fœtidi extrorsum et leviter antrorsum directi, nonnihil longiores quam ad basin latiores, ad apicem oblique truncatum versus nonnihil angustiores, coriacei, parce pilosi. Nodus apicalis magnus, fortiter convexus, nitidus itaque oculum magnopere simulans.

Venter leviter convexus. Sulci obliqui curvati, lati, marginem lateralem corporis et vix arculos genitales attingunt. Sulci transversi recti. Operculum anale utriusque sexus suborbiculare, convexum.

Antennarum articulus primus vix triplo longior quam ad basin latior, ad basin paullo latior quam conus fœtidus, supra manifesto infra vix granulatus; carina dorsualis transversa subbasalis manifesta;

tuberculum inferius et exterius magnum, acutum, post apicem coxae I positum. Articuli secundi pars citerior articulo primo dimidio longior, paullo plus duplo longior quam latior, extra convexus, processu brevi, late triangulo, acuto, superiore, citra basin digitorum posito, instructus. Articulus tertius parte citeriore articuli secundi paullo plus quam dimidio brevior.

Pedes sat graciles. Femora I manifesto, II vix deorsum curvata, III et IV recta. Patellæ tibiis: I vix quinta parte, II paullulo, III et IV non breviores. Tibiae III dimidio, IV duplo longiores quam crassiores. Metatarsi I et II ultra medium oblique leviter constricti, parte citeriore granulata et parte ulteriore lœvi. Tarsi, ubi crassissimi, tibiis I, II, III manifesto tenuiores.

Differentia sexualis: Tarsus IV feminæ manifesto, maris vix tenuior quam tibia; maris in basi dorsuali manifesto incrassatus et dilatatus, non duplo longior quam crassior. Eminentia dorsualis tarsi IV (maris) subbasalis; pars basalis, ab ipso articulo non bene limitata, oblique conica, vix compressa, paullo humilior quam ad basin longior; pars apicalis parte basali tenuior et longior, fere subulata, ad partem citeriorem tertiam (ubi orificium glandulae positum est) subito gracilior, retrorsum et paullum extrorsum curvata.—Operculum genitale vix vel non limitatum; margine anteriore operculi maris subrecto; operculum feminæ perlatum, margine anteriore alte elevato, late emarginato, lateraliter, prope aperturam genitalem angulato; paullum post marginem anteriorem adest impressio sat profunda, ad latera versus retrorsum curvata, margini laterali operculi subparallelia. Arculi genitales a coxis IV vix limitati; maris perlati, pars posterior et lateralis, longior quam apertura genitalis, leviter convexa; secundum aperturam genitalem mediocrem, manifesto latiorem quam longiorem, costa latior adest, ante cum costa transversa, ad marginem anteriorem coxae posita, confluens. Arculi feminæ sat angusti, secundum operculum leviter convexi; margines sat elevati aperturam genitalem permagnam ante et lateraliter cingentes. Post aperturam genitalem feminæ nodulus utrinque adest.

Castaneus, ventre vix dilutiore. Membra et coni fœtidi fulva.

Long. corp. ♂ 1·78, ♀ 1·8 mm.; long. cephalothor. ♂ 0·77, ♀ 0·74 mm.; lat. max. ♂ 0·85, ♀ 0·93 mm.; antennæ ♂ ♀ 1 mm.; palpi ♂ 1·2, ♀ 1·1 mm.; pedes I ♂ 1·9, ♀ 1·8; II ♂ 1·6, ♀ 1·4; III ♂ 1·4, ♀ 1·25; IV ♂ 1·6, ♀ 1·4 mm.

Patria: Corsica. Ill. Simon dicit: Sub lapidibus, in humo profunde sitis, post imbræ vulgaris. Exempla quinque vidimus, quorum mares duos et feminas duas nobis ill. E. Simon benevolentissime dedit, mas unus in Museo aulico Vindobonensi asservatur.

SPECIES INCERTÆ SEDIS.

Ill. professor Dr. T. Thorell nos docuit, se literis cl. cuiusdam professoris didicisse, speciem Americæ septentrionalis incolam esse, cuius unguis pedum (modo *Parasironis*) pectinati sint.

Siro cyphopselaphus Joseph.

- 1868. Cyphophthalmus duricorius G. Joseph partim ('Berl. Ent. Zeitschr.', xii., p. 269, Tab. I., Fig. 15¹).
- 1882. Siro cyphopselaphus G. Joseph ('Ibid.', xxvi., p. 20).
- 1896. Siro cyphopselaphus Hamann ('Europ. Höhlenfauna', p. 215).

Patria: Austria, provincia Krain. In caverna "God jama der Ober Skril" ab ill. G. Joseph inventus.

Teste ill. G. Joseph haec species dilutior et aliquanto minor et latior est quam *Siro duricorius*, a quo hac nota magni momenti differt: coni fœtidi non "oculis" sed pilis singulis sensitivis longis prædicti. Qua de causa generi suo fortasse attribuenda est haec species.

¹ Quamquam ipse auctor dicit: "Der dickere Scheerenkiefer [antenna] Fig. 3 auf Tfl. I. der vorgenannten Abhandlung gehört nicht zu duricorius, sondern zu S. cyphopselaphus," et quamquam verba sequentia antennam in Fig. 3 delineatam

describunt, non dubitamus, quin verba "Fig. 3" e lapsu calami (pro Fig. 15) dependeant. Nam Figg. 1—13 omnes specimen typicum, tunc unicum (Berl. Ent. Zeitschr., xii., p. 241: "das Thier, ein Unicum") S. duricoriis illustrant.

SPECIES AD HUNC SUBORDINEM NON PERTINENS.

Siro inaequipes Karsch.

1884. *Siro inaequipes* Karsch (‘Ueber die Arachniden-Familie der Sironoiden und über einen neuen Siro aus Asturien. Berlin. Ent. Zeitschr.’, xxviii., pp. 143—146).

E descriptione brevissima, ab ill. Karsch data, non elucet, utrum hæc species ad genus *Sironis* pertineat annon. Cl. autem professor Dr. F. Dahl nos docuit, ipsum Karsch postea intellectuisse, speciem dictam non ad genus *Sironis* sed ad genus *Calathocrati* Sim. (familiae Troguloidarum, subordinis Opilionum Palpatorum) pertinere. Et delineationes tarsi et partis anterioris cephalothoracis, a cl. F. Dahl benevolentissime misse, nobis demonstraverunt, hoc animalculum ad genus *Calathocrati* revera tribuendum esse. (Ceterum censemus, ill. Karsch erravisse, dicentem: “innerer Finger der Scheerenkiefer [forcipum antennarum] deutlich gegliedert.”)

SPECIES NON EXISTENS.

Gibocellum sudeticum Stecker.

Hoc de monstro fabuloso inspiciantur, quæ in capitulo 14 (pp. 67—75) hujus tractatus seripsumus.

II. THE ORDER RICINULEI. (THE FAMILY CRYPTOSTEMMATOIDÆ.)

A. HISTORICAL INTRODUCTION.

VERY few species of this but little known order have as yet been published. The earliest known was described (*a*)¹ and depicted (*b*) by Guérin-Méneville in 1838 from a specimen, which our countryman Westermann had obtained from the coast of Guinea, and it was on that account named *Cryptostemma Westermannii*. A second species was discovered by Bates on his voyage in the basin of the Amazon River, and was published by Westwood (p. 201) under the name of *Cryptocellus fœdus*. A third species, like the first from Africa, was described by Thorell (*h*) as *Cryptostemma Afzelii*, whilst Karsch (*c* and *d*) described a species which he referred to *Cryptostemma Westermannii*, but which is certainly not identical with the one published by Guérin-Méneville under that name. The original specimen of *Cryptostemma Westermannii* seems unfortunately to be lost; at any rate neither Professor E. L. Bouvier, Director of the Entomological Department of the Museum of Paris, nor M. E. Simon has been able to give any information concerning it. The original specimens of the two other species, as well as those which Karsch referred to *C. Westermannii* and fresh material of this species itself, have very kindly been entrusted to us for examination. Besides these we are fortunate enough to be enabled to describe four entirely new species, viz. three from Africa belonging to *Cryptostemma*, and one from South America of the genus *Cryptocellus* Westw., which latter genus does not differ much from the first-named². As far as the number of species of Ricinulei is concerned we have consequently had much more ample material at our disposal than our predecessors, none of whom knew more than one species; but, as regards specimens, we have not been so well situated for the study of Ricinulei as for that of Cyphophthalmi, because of five only out of our eight species have we had more than one specimen before us. Nor have we had any opportunity of dissecting more than one specimen, an example of *Cryptostemma crassipalpe*, for which we are indebted to the kindness of Professor C. Auri-villius. As, moreover, this specimen was young and rather small, we thought it wiser to confine our investigation to particulars on which there was a prospect of attaining trustworthy information, the anatomy of the mouth, the external organs of sense, and the respiratory organs, leaving unattempted the anatomy of the inner organs. The results of our examination, however, will at any rate suffice to fix the systematic position of the group. But the discussion of this question may be conveniently postponed until we have given an account of the main anatomical features of the type. Only so much we would premise, for the guidance of our readers, that we are unable to agree with the view of Guérin, Gervais, Westwood and Thorell, that the genus *Cryptostemma* or the family Cryptostemmatoidæ Westw. belongs to the order of Opiliones. In our opinion it constitutes an order apart,

¹ With regard to the literature cited we refer to the list at the end of this paper.

² Karsch is doubtless justified in suggesting (*b*, p. 31)

that Westwood was led to establish the genus *Cryptocellus* by his having misunderstood an ill-chosen expression of Guérin's, but the genus may nevertheless be maintained.

most nearly related to that of Pedipalpi, and more particularly to the sub-order Uropygi¹. In so far, therefore, we agree with Karsch, when he says (*c.* p. 29) that if this new type were to be forced into one of the accepted now living orders, it would have to be as a suborder of Pedipalpi. But Karsch himself has not supported this opinion by reference to any point of agreement between Cryptostemmatoidæ and Pedipalpi, nor does it appear to us that his description very clearly conveys the notion of any such agreement². He refers Cryptostemmatoidæ, under the name of Poliocheridæ, to the order of Meridogastra, which otherwise comprises only extinct forms—a view which we shall examine further below.

B. ON THE GENERAL STRUCTURE OF THE ORDER.

1. *The Dermoskeleton.*

The integuments are distinguished by extraordinary thickness and hardness; for instance, in a young specimen of *Cryptostemma crassipalpe*, 4·7 mm. long, the tergites of the abdomen had a thickness of from 0·11 to 0·19 mm., and the connecting membrane between the third and the fourth tergite measured in one place as much as 0·21 mm. in thickness. In some species the sculpture is rather remarkable, and three of the species possess an extremely characteristic covering of hair. The surface of the body and the legs is in most species wholly, in the others at least partly, covered with granular protuberances, standing in no particular order, but generally not close together. In some of our species each of these granules exhibits at its apex a depression in which a small lenticular prominence is noticeable; in *Cryptostemma Karschii* and *Sjöstedtii* this arrangement is not quite easy to observe, but it is very plain in *C. Afzelii* (Pl. VIII., fig. 2c). In *Cryptostemma crassipalpe* and *plebeium* the granules are very conspicuous by their reddish colour, and have a very beautiful and peculiar appearance (Pl. VII., figs. 1*t* and 1*u*) owing to their surface being adorned with fine grooves, which partially are transverse, partially unite towards the apex of the granule.

The granules are as a rule interspersed with rather numerous hairs, which in *Cryptostemma crassipalpe* and *plebeium* are developed into very large curved scales, contracted at the base, whilst their upper convex side exhibits a longitudinal groove, and is covered with a multitude of short fine capillary excrescences. The shape of these scales is mostly as represented on Pl. VII., figs. 1*r*, 1*s*, 2*e* and 2*f*, but some, particularly on the ventral surface, are almost flat, and transitions between these shapes occur; some might be described as spatulate, with extremely delicate excrescences along the margin. It is possible that these remarkable hairs, which look so much like scales, have some special function, but we are not inclined to venture on a guess as to what it may be.

¹ It will be remembered that Thorell (*i.* p. 526 sequ.) has divided Pedipalpi into two sub-orders: Amblypygi (with the family Phrynidæ) and Uropygi, the latter comprising two tribes: Oxopoei (the family Thelyphonoidæ) and Tartarides (with the family Schizomoidæ (Schizonotoidæ auct.)).

² It is true that Karsch rightly mentions that the palpi

in *Cryptostemma* terminate in a small chela—a point in which Ricinulei agree with some Pedipalpi (Oxopoei)—but Karsch himself says that a small chela terminating the palps is without an analogue amongst now living Arachnida (*c.* p. 29).

2. *The Cephalothorax.*

The two principal divisions of the body are, as in Pedipalpi, connected by means of a peduncle formed by the fore-end of the abdomen, and as in Uropygi it is rather broad. They are besides coupled together by a mechanism which is quite peculiar to Ricinulei, and which depends essentially on special adaptation of the anterior extremity of the abdomen. We shall describe this more in detail, when we have treated of the cephalothorax and the abdomen separately.

The cephalothorax is rather clumsy in shape, being of about equal length and breadth, though the species differ somewhat in this respect. The dorsal surface of the cephalothorax is more or less convex. Its broadest part is just behind the middle, in which place it shows a rounded lateral angle (our "angulus submedius") placed a little behind the space between the second and the third pair of coxae. From this point forwards the cephalothorax is somewhat narrowed, more so in *Cryptocellus* than in *Cryptostemma*.

Cucullus.—Anteriorly the cephalothorax terminates in a large, transversally elliptic, very moveable plate, which articulates with the cephalothorax and then deflected covers the antennæ, the oral orifice and the dorsal surface of the mandibles. Its posterior margin forms a short transversal ridge; the (upper) anterior surface is convex with a double curvature, and shows in several species a couple of longitudinal grooves. Thorell has already pointed out that the under surface of this plate is concave, and divided into two portions, into which the basal joint of the antenna on either side fits. The ridge which separates these portions is rather high in *Cryptocellus Simonis*, low in *Cryptostemma crassipalpe* (Pl. VII., fig. 1 e), and very low in *C. Afzelii*. On the outer side each of these concave portions is bordered by a high longitudinal ridge, which starts from the posterior corner of the cucullus, and to the base of which the powerful muscles are attached by which the cucullus is moved, as shown by Thorell (*h*, p. 11). Along the anterior margin of the concave surface there is a row of rather long and delicate hairs, which are *not* plumose.

We have adopted the name given by Thorell to this piece, which was described by Westwood as labrum, and by Karsch as clypeus, both of which names are equally misleading. Guérin-Méneville and Gervais compared it to the plate which projects above the antennæ and the parts of the mouth in *Trogulus*, and were thereby led to place *Cryptostemma* near that genus in the order of Opiliones. The justice of this comparison—though not of the conclusion which those authors founded upon it—is in our opinion more clearly evidenced by the fact to which we would here draw attention, that a structure corresponding morphologically to the cucullus in *Cryptostemmatoidæ* exists in *Thelyphonoidæ*. In this group we find that a portion of the basal joint of the antennæ is covered in a similar manner as in *Cryptostemmatoidæ* by the projecting anterior part of the cephalothorax, and it is on this part that the central pair of eyes are placed, whilst on its under surface there are two excavations corresponding to the basal joints of the antennæ. In short we look upon the cucullus as the first segment of the cephalothorax which carries the eyes—the procephalic lobe of embryologists. The truth of this view cannot be demonstrated in a decisive manner, because none of the *Cryptostemmatoidæ* as yet known possesses eyes; but considering that the cucullus articulates with the cephalothorax, and that the part of the latter which projects in a similar way in *Thelyphonoidæ* carries the front eyes, we have no doubt as to the proper interpretation

of the cucullus. Sörensen (*a*, pp. 505—507) has shown that the plate which projects above the antennæ and the parts of the mouth in *Trogulus* is in reality formed by the union of two large flat projections of the eye tubercle, and—contrary to the opinion of Karsch—we believe these flat projections in *Trogulus* to be really the morphological equivalents of the cucullus in *Cryptostemma*, because in two genera belonging to Troguloidæ, viz. *Dicranolasma* and *Amopaum*, these plates are free anteriorly, and carry each one eye. This proves decisively that they belong to the first segment of the cephalothorax. How far this segment reaches back on the cephalothorax in Troguloidæ and Thelyphonoidæ cannot be determined, whilst it is free posteriorly in Cryptostemmatoidæ.

The dorsal surface of the cephalothorax is marked by a varying number of grooves of which only the two most important need be mentioned here. The first of these is a longitudinal groove of somewhat varying length, in some cases terminating posteriorly in a short and shallow transverse groove, which probably indicates the boundary between the head and the thorax, such as doubtless is the case with the transversal impression on the cephalothorax of most Aranæ theraphosæ Sim. (Ar. tetrapneumones Latr.) and Phrynidæ. Secondly we have to mention a sometimes rather slight transverse groove (our “sulcus transversus posterior”) which probably marks the boundary between the two thoracic segments, as it terminates on either side of the cephalothorax, opposite the space between the two hindmost pairs of legs. Behind the last-mentioned groove the cephalothorax is rounded rather steeply downwards to what looks like its posterior margin, but which in reality is only a projecting, transverse, slightly downward-bent ridge, and constitutes a part of the mechanism for coupling together the cephalothorax and the abdomen. The lower surface of that produced ridge is, in reality, the continuation of the dorsal surface of the cephalothorax, and the real posterior margin of cephalothorax is found at the end of the lower surface mentioned, and has the character of an extremely thin ridge bounded by a shallow groove.

It should be added that the solitary pair of spiracles is placed on the cephalothorax, not, as has been quite naturally supposed, on the abdomen.

Sternum.—It is not visible from the outside between the coxæ of the second, third, and fourth pairs, because these latter all meet externally in the middle line of the body; but it is plainly seen on the inside of the dermoskeleton. The central portion of the sternum is a small somewhat oblong plate, situated behind the posterior margin of the second pair of coxæ and between those of the third pair; when the fourth pair of coxæ are removed (Pl. VII., fig. 1c) this plate (*st.*) is seen to project behind the third pair. From the under surface of this plate a narrow strip proceeds on either side along the posterior upper margin of the third pair of coxæ, to which it is firmly united, and near the lateral margin of the cephalothorax it is seen to be continued in a triangular plate, inside the lateral border of the cephalothorax, on which the spiracle on either side is placed. Anteriorly the plate above-mentioned is continued between the coxæ of the second pair, in the shape of a narrow strip, widening a little at its anterior extremity, from which another narrow, transverse strip proceeds along the upper margins, first of the second and beyond this, of the first pair of coxæ, as far as to the lateral border of the cephalothorax. In front of the anterior margin of the second pair of coxæ we notice an extremely small free projection from the middle portion of the sternum, which lies a little lower than the strip along the anterior margin of the coxæ, and which on the dorsal side carries the labial setæ (Pl. VII., fig. 1c, *l*), which will be treated of more fully in the description of the mouth.

3. *The Abdomen.*

Whilst Guérin-Méneville and Westwood cautiously state that the abdomen appears to consist of four segments, Karsch (*c.*, p. 30) gives this number without hesitation. Thorell indicates besides the same four segments also a "segmentum anale," of which, however, he says (*h.*, p. 13) that he is uncertain whether it ought to be looked upon as formed by the coalescence of the tergite and sternite of a fifth segment. What he describes as "segmentum anale" is a small protuberance at the posterior extremity of the abdomen, on which the anus is placed, or rather, as we shall see, appears to be placed.—We have on the contrary distinguished nine segments with certainty. On morphological grounds it must be considered possible, though little probable, that in reality one more segment enters into the composition of the abdomen, but if so it is not discernible. Our starting-point in the sequel, as well as in the Latin description of the species, will therefore be that number which we have actually found. That our predecessors have not found more than four or five segments is easily explained, because the others are very difficult to distinguish, and because the difference between the segments as regards size is so great, three of them, the fourth, fifth and sixth (the second to the fourth of earlier writers) being very large, the third rather large, whilst the others are small or even very small, and partly hidden.

The tergites of the fourth, fifth and sixth segments are each divided into three areas, of which the middle one is the largest. These areas, as well as the tergites themselves, are in young animals separated from each other by a broad, softer and more light-coloured connecting membrane which, however, is of extraordinary thickness, and therefore scarcely allows much movement of the pieces. It is an interesting fact that the granules of which so great a multitude adorn the tergites of these animals occur also, though in smaller numbers, both on the connecting membrane between the tergites themselves, and on the lateral membrane connecting the tergites with their sternites—a feature which, as far as we know, recurs only in Thelyphonoidæ, and, to a small degree, in Phrynidæ, where it may be observed in the lateral connecting membrane between the tergites and the sternites. By degrees, as the animals grow in size, the interstices between the tergites, as well as between their middle and lateral areas, diminish, and in adult specimens they are found almost coalesced, the connecting membrane appearing only in the shape of quite narrow strips. The sternites of the fourth, fifth and sixth segments are not divided into areas (Pl. VII., fig. 1 *b*), but the connecting membrane between them is very thick and tough, and becomes narrower with age, as in the case of the tergites, until the sternites of these three segments coalesce with each other and with that of the third segment so as to form a ventral shield, on which the boundaries between the segments are marked only by feeble transverse lines; the boundary between the third and the fourth sternite is more strongly marked (Pl. IX., fig. 1 *g*), particularly towards the sides where it appears as a somewhat deeper groove. Both on the tergites and on the sternites of the fourth, fifth and sixth segments a pair of depressions are noticeable, as on several segments in Phrynidæ¹. These correspond to the

¹ In *Neophrynus palmatus* (Hbst.) Kraep. six pairs of such depressions exist on the tergites of the third to the eighth segments; four pairs of corresponding depressions are seen on the sternites of the fifth to the eighth segments. The four pairs of muscles of which the points of insertion are

marked on the outside by these depressions on the fifth to the eighth segments extend from the dorsal to the ventral surface, and a similar pair of muscles exists in the fourth segment, although their points of insertion on the inside of the sternite are not visible outside; but the muscles which

points of insertion of powerful cylindrical muscles extending from the tergites to the sternites, which by their action are drawn near to each other, thus flattening the abdomen.

The tergite of the third segment is considerably shorter than that of the fourth, reaching as it does no further forward than to the bottom of the deep groove (Pl. IX., fig. 1 *f*) in front of the semilunarily emarginated line, which apparently constitutes the anterior margin of the abdomen (compare Pl. IX., fig. 1 *f* with Pl. IX., fig. 1 *a*, *C. Karschii*; and Pl. VII., fig. 2 *a*, *C. plebeium*). In the young specimen of *Cryptostemma crassipalpe*, which we have dissected, we noticed at the bottom of this groove a narrow strip of softer integument, forming a connecting membrane between the third and the second tergites. In adult animals of *Cryptostemma Karschii* these two tergites seem to have coalesced, but the boundary between them is marked by a line near the anterior corner of the abdomen, as may be seen on Plate IX., fig. 1 *f*. The third tergite is, at least as a rule, divided into a central area and two lateral ones¹. The third sternite is so plainly seen on Pl. VII., fig. 1 *b* and Plate IX., fig. 1 *g* that we need not treat of it further in this place. The tergite of the second segment (Pl. IX., fig. 1 *f*, *d*²) is quite short, in fact little more than a crescent-shaped transverse strip.

We have already mentioned that the abdomen is connected with the cephalothorax by means of a peduncle which, however, is so short that it is scarcely visible in the normal condition of the body, when the abdomen and the cephalothorax are coupled together. In one of our specimens of *C. Karschii*, a male, the abdomen was broken off from the cephalothorax, and though it was not in the best of conditions, we were thereby enabled to study this part more closely. Amongst other particulars we noticed that the tergite (*d*¹) of the first abdominal segment, the peduncle, is of half the width of the posterior margin of the third tergite (Pl. IX., fig. 1 *f*). As in Araneæ², and for the matter of that also in Amblypygi³, the principal firm element in the composition of the peduncle is the tergite of the first abdominal segment. This is quite short, of about one-third of the width of the second tergite, and does not consequently reach the sides of the peduncle. It is comparatively feebly chitinized, and consequently only light brown in colour; it is connected with the surrounding parts by means of a really soft and flexible connective membrane. In the young specimen of *C. crassipalpe* we failed to discover with certainty any chitinized tergite in this place.

In one of our specimens of *C. Afzelii* the abdomen was abnormally bent upwards so much that the sternites of the two first abdominal segments were visible (Pl. VIII., fig. 2 *g*). They (*v*¹ and *v*²) are of about equal size, nearly crescent-shaped, their concave margins turning against each other. They too are connected with the surrounding parts by means of a soft very flexible connective membrane. It will appear from what we shall state below concerning

are inserted on the tergites of the segments in front of the fourth, appear to be directed forward, not from the dorsal to the ventral surface. In *Thelyphonous* four pairs of muscular insertions are marked by depressions on the outside of four sternites, viz. on those of the fifth to the eighth segments. On the tergites seven pairs of depressions are noticeable, viz. on those of the second to the eighth segments.

¹ In the youngest of our specimens of *C. crassipalpe* we found the lateral areas of the fourth, fifth and sixth tergites so weakly developed that they could scarcely be discerned; in the somewhat older specimen, which we dissected, the third tergite did not exhibit any lateral area.

² In Araneæ the sternite of the "peduncle" is generally not chitinized. Cfr. Simon (*e*, pp. 4—6) and Sørensen (*f*).

³ In Amblypygi the sternite of the first abdominal segment is but little developed (Sørensen, *f*); in Thelyphonoidæ (Hansen *b*, p. 165) it is a broad, not particularly short, very firm plate; in Tartarides (Hansen and Sørensen, *b*) this plate is rather slightly chitinized, broad, but very short; in Palpigradi (cf. Hansen and Sørensen, *a*, p. 232) the first segment is very slightly chitinized, and, as is the case with all the abdominal segments, not divided into tergites and sternites.

the mechanism by which the abdomen and the cephalothorax are coupled together, that the position of the former in this specimen was abnormal; when these two principal divisions of the body are coupled together, as they normally are, the first and second sternites are completely hidden¹. In the relatively large piece of soft skin, which exists between the first and the second sternites the sexual orifice (Pl. VIII., fig. 2 *g, o*) is seen in the shape of a broad transversal slit.

Thus the sexual orifice is here situated between the first and the second sternites, but in those orders to which Ricinulei are most nearly related, the sexual orifice is differently placed, viz. either in the posterior portion of the second segment (Palpigradi) or at the posterior margin of the second sternite (Pedipalpi, Araneæ). The question might therefore fairly be raised whether after all there may not also in Ricinulei exist one more segment in the abdomen, in front of those we have seen, in which case the sexual orifice would be placed behind the second sternite.¹ We have had difficulty in examining this portion of the abdomen in *Cryptostemma*, but we do not consider the existence of such a further segment probable, because, in that case, the peduncle in Ricinulei would contain two entire segments, but this would be without a parallel in Arachnida with pedunculated abdomen; in some Araneæ a portion of the second segment enters into the peduncle; but otherwise only one entire segment is known to do so.

The seventh, eighth and ninth segments (Pl. VII., fig. 1 *q*) are quite small and form a small "tail." They are completely annular, not divided into tergites and sternites; they diminish gradually in diameter towards the posterior extremity, and can be drawn together like a telescope. This is probably their normal condition, at least in the adults, in which even the seventh segment is more or less completely drawn back into the wide part of the abdomen, so that the tail is visible only as a small protuberance, on which the posterior margins of the eighth and ninth segments are discernible only by very close examination, as two concentric circles. This is of course the reason why these segments have been overlooked by our predecessors except by Thorell, who, however, has interpreted them as constituting a kind of anal segment. At the extremity of the ninth segment we find the anus (Pl. VII., fig. 1 *q, a*) in the shape of a small transverse slit of which the upper border is slightly emarginate; but there are no other orifices in this segment, from which it is clear that there are no such glands here as are found in Uropygi.

Amongst the orders of Arachnida, four, viz. those of Pedipalpi, Palpigradi, Araneæ and Ricinulei, appear to be more closely related to each other than to the other six orders, viz. Scorpiones, Chelonethi (Pseudoscorpiones), Solifugæ, Opiliones, Acari, and Linguatulina, whose relationships to one another, and to the four first-named orders, appear to us somewhat obscure. One of the distinguishing characters which those four orders have in common is the existence of a more or less developed, but always short "tail," consisting of three segments, with reference to which we propose the general name of "Arachnida micrura" for these orders. A few remarks on the structure of this tail in the other three orders may therefore not be out of place. In none of these orders can the tail be telescoped as in

¹ In that specimen of *C. Karschii* on which the cephalothorax and the abdomen were separated, these two sternites were lost, and in the young specimen of *C. crassipalpe*

which we have dissected, they were not sufficiently strongly chitinized to attract notice.

Ricinulei. In Palpigradi the last segment is furnished with a long, thin, many-jointed flagellum. The segments of the tail in the Palpigradi are not divided into tergites and sternites, but this is not of any consequence, as equally no such division exists in any of the other abdominal segments. Nor do the segments of the tail in Uropygi exhibit separate tergites and sternites, and on the last segment are placed the orifices of two glandular bags, which in Oxopoei are known to contain a liquid secretion smelling like acetic acid. It is also on the last segment that we find a supra-anal appendage, which in Oxopoei has the form of a long, many-jointed flagellum, with a thick basal joint, whilst in Tartarides it forms a short style, either undivided or exhibiting a few feebly-marked joints. In Amblypygi there exists, as is equally well known, no supra-anal appendage on the last segment of the "tail," which is comparatively short and broad, and of which the two first segments exhibit separate tergites and sternites. The latter is not the case with the anal segment¹, but on its dorsal surface we find a large and broad, very movable free plate which covers the anus as a kind of anal valve; the orifice in question is not seen till the valve is lifted up considerably. In Araneæ the "tail" is extremely small and placed as it were in a heap with the mamillæ, for which reason it is generally overlooked. For further details on this subject we refer to the treatises by Simon (*e*, p. 4) and Sørensen (*f*), and shall only add in this place that it is not always possible to point out all three segments of the "tail" in Araneæ, which is quite in keeping with the fact that in these animals the division of the abdomen into segments has to a great extent disappeared. In some cases, however, they are all very readily recognized, particularly in Orbitelariæ, for instance in a *Nephila* or a large *Epeira*.

4. The Coupling of the Abdomen with the Cephalothorax.

(Pl. IX., figs. 1*f* and 1*g*)

The abdomen and the cephalothorax are coupled together by the following adaptation of these two parts of the body and of the fourth pair of coxae.

The transversal ridge on the cephalothorax, which we mentioned above as forming apparently the posterior margin of the cephalothorax, is a little concave on that side which turns downwards (or forwards), and at the same time higher in the middle than laterally. This side is altogether smooth, which is also the case with the surface of all those parts of the abdomen and the coxae which play a part in the coupling.

On the dorsal surface of the abdomen (Pl. IX., fig. 1*f*) we notice first of all a deep, crescent-shaped groove on the confines of the second and the third tergites (*d*² and *d*³), which is deeper in the middle than towards the sides. The posterior wall of this groove is formed by the tergite of the third segment and almost perpendicular, whilst the anterior wall, which is formed by the tergite of the second segment, slants upwards and forwards almost in its whole length. The above-mentioned ridge, near the posterior margin of the cephalothorax, fits into this groove.—On either side of the body the sternite of the third segment (Pl. IX., fig. 1*g v*³) reaches a little further forward than the tergites of both the second and

¹ This segment is not always easily observed. In *Titanodamon medius* (Hbst.) Kraep. the dorsal portion of the anal segment (apart from the anal valve) is rather large, but in

Neophrynus palmatus (Hbst.) Kraep. it is small (short) and easily overlooked.

the third segment, so that, even when viewed from above, the most prominent portion of the lateral corners of the abdomen (which are turned a little inwards) is formed by the third sternite.

On the *ventral surface of the abdomen* (Pl. IX., fig. 1*g*) we find an adaptation of the sternite of the third segment, serving the same purpose but quite differently contrived. The anterior border of the plate in question (*v³*) is rather deeply emarginate on either side between the lateral corners of the abdomen (which as we have said are formed by that plate) and the middle, which does not reach so far forward as the corners. Behind this emargination the ventral surface of the sternite exhibits on either side a somewhat deep concave portion, of which the posterior margin is uniformly curved from a point situated well forward on the projecting portion in the middle and near the middle line, to a point on the side situated a long distance behind the fore-end of the lateral corner, and somewhat nearer the middle line than the latter. The concave portions are thus bounded anteriorly and posteriorly by somewhat curved lines, but laterally by straight lines which converge a little towards the posterior end of the body. The bottoms of the concave portions are not quite plane, and at the same time somewhat deeper behind and distally, where the walls of the excavation a little overhang the excavation, which consequently in these places has the shape of a shallow pocket; this is not visible on our figure. Into these excavated spaces the posterior free portions of the fourth pair of coxae fit together with their keels. Only a portion of the dorsal surface of the fourth pair of coxae is attached to the ventral surface of the cephalothorax: the distal portion, about two-fifths of the length of the coxae, is free, and exhibits along its posterior border a free expansion, which is continued as a horizontal keel (Pl. VIII., fig. 2*g, k*) with convex margin. The dorsal surface of this keel forms a continuation of the dorsal surface of the free part of the coxa, whilst the ventral surface of the keel is sharply marked off from the ventral surface of the coxa. The whole of the free part of each coxa of the fourth pair fits into the concave space of the ventral surface of the sternite of the third abdominal segment, the keels more particularly fitting into the pocket-like hollow places above described at the posterior extremity of the concave spaces. The consequence is that when the abdomen and the cephalothorax are coupled together no more of the third sternite is seen than the triangular portion between the two excavations (Pl. VII., fig. 1*b*).

To complete the description of this part of the abdomen we may add that those portions of the sternite of the third segment and of the tergite of the second segment, which lie between the soft part of the peduncle and the projecting lateral corners, are strongly chitinized, and form on either side two somewhat concave surfaces which turn forward, for which reason they are seen on Pl. IX., figs. 1*f* and 1*g*, very much foreshortened, as deeply shaded places; they are separated by a horizontal keel, of which the top edge is represented (*k*) in both the figures as the anterior margin of the shaded parts just mentioned.

When the coupling is effected the projecting lateral corner of the abdomen enters into the space between the free distal part of the fourth coxa on either side and the lateral portion of the dorsal shield of the cephalothorax, and fits into a hollow bounded by the lateral portion of cephalothorax, and—beneath—by the upper surface of the free distal portion of the third coxa.

We have described this remarkable mechanism principally according to its appearance in *Cryptostemma Karschii*. It is found in all the species we have seen, but the shape of the component parts, at any rate of the concave spaces on the third sternite, is not quite the

same in all species. At the same time the differences are, as far as we have been able to ascertain, of small importance.

The fact that the coxae of the fourth pair are movable, whilst all the others are immovably united, proves that the animal is able to move the abdomen up and down, though probably not much, when it is coupled to the cephalothorax. We do not doubt that the animal is able both to effect and to undo the coupling at pleasure. In fact that specimen of *C. Afzelii*, of which we have figured the first and second sternites (Pl. VIII., fig. 2 g), had the abdomen disconnected, which was not the case with any of the other specimens of Ricinulei which we have seen. During the pairing and the deposition of the eggs the connection must be undone, in order to open a free passage to and from the genital orifice.

5. The Limbs¹.

1. The *Antennæ* (Pl. VII.—IX., several figures) are capable of considerable retraction and protrusion, as in scorpions. They can be drawn back so much that hardly more than the points are visible when the cucullus is lifted up. This is rendered possible through the basal joint being connected with the cephalothorax by a very thin and loose membrane, which becomes more or less folded round the proximal portions of the basal joint when the antenna is drawn back. The consequence is that when the antenna is taken out it looks as if the connecting membrane was attached to it a certain distance from its base (Pl. VII., figs. 1 f and 1 g).

The antennæ consist of two joints, and are distinctly chelate, particularly in *Cryptocellus*. The basal joint is very stout, roughly trilateral. The inner side (the one that turns towards the middle line of the body) and the ventral side are nearly plane, but the dorsal (front) side is convex, and its convexity is so salient towards the inner side as to form a low, rounded cone (Pl. VII., fig. 1 g; Pl. IX., fig. 1 c); in *Cryptocellus Simonis* the convexity is less striking than in the other species. In *Cryptostemma* two strong processes are placed opposite the articulation between the basal and the terminal joints, one on the dorsal, the other on the ventral side (Pl. VII., fig. 1 f), between which the second joint is received when the chela is closed. The one (p^1) on the dorsal side is always much smaller than that (p^2) on the ventral side, which is always large, and longer than broad. On the latter the dorsal side is, as it were, sharpened along the margin, which turns towards the second joint of the antenna, so as to form an edge, inside which we notice a groove near the base of the joint. The edge is very prominent and armed with four or five teeth. In *Cryptocellus* (Pl. IX., figs. 2 c and 3 d) only one such process exists, viz. the large one on the ventral side; it is somewhat longer than the corresponding one in *Cryptostemma*, whereby the antenna is rendered more chelate in *Cryptocellus*. Towards the distal extremity the ventral side of the joint is furnished with a broad, slantingly-transverse belt of close-set hairs (Pl. VII., fig. 1 h), which are delicately plumose all round, and of which those nearest the distal extremity are the longest. On the dorsal side of the joint (Pl. VII., fig. 1 f) a similar but narrower obliquely transverse belt of hair occurs, which becomes narrower as it approaches the middle

¹ In the sequel the limbs are described as they would appear when occupying a horizontal position without regard to any flexion or torsion in any of their articulations. We describe for instance as dorsal that side of the antennæ

which in its natural position would be seen in front; we describe as ventral that portion of the palpi which the femoral and the tibial parts turn against each other.

of the surface where it terminates; besides some hairs are found along the distal part of the outer margin. The function of these hairs is no doubt to intercept the blood of the prey when this has been cut to pieces. Hairs serving this purpose, frequently collected into clusters or brushes, are of frequent occurrence in Arachnida, armed with powerful cutting or clipping antennæ, such as Scorpiones, and in a still higher degree Pedipalpi.

The second joint is curved like a sickle, particularly in *Cryptocellus*. Its transversal section is nearly triangular. In *Cryptostemma* the ventral surface is only slightly sharpened into the cutting edge, whilst that side of the joint which is opposite the process of the first joint is excavated longitudinally and more prominent towards the ventral surface (Pl. IX., fig. 1 c). In *Cryptocellus Simonis* (Pl. IX., fig. 3 d) the transversal section of the joint is somewhat different, as it is broader, and at the same time thicker along the convex side, and the edge is sharper because the slant which forms the edge and which is seen on the dorsal surface commences a little inside the convex side. The edge is sometimes sharply serrate, but is also found merely to a greater or less extent crenulate. The articulation between the joints is very strong.

2. The second pair of Limbs or Mandibles (maxillæ auctt.) and their Palpi (Pl. VII., figs. 1 b and 1 k—1 n). In Ricinulei the basal joints of these appendices are united to each other, as in Uropygi, but to a much greater extent than in these latter, whilst in all other Arachnida, apart from Aeari, they are free. In Uropygi the mandibles are coalesced in the middle line, but in Ricinulei they fuse almost entirely; a groove-like structure is, indeed, visible on the lower surface of their uncovered part (Pl. VII., fig. 1 b), but on that portion of their lower surface which is covered by the second pair of coxae (Pl. VII., fig. 1 k), and on the upper surface (Pl. VII., fig. 1 m) no vestige of a suture is visible. The mandibles of Ricinulei exhibit this further difference from those in Uropygi, that they are destitute of any anteriorly projecting part, such as is found in all Pedipalpi, though otherwise Uropygi differ much from Amblypygi in the structure of the mouth. It will be convenient to postpone the more detailed description of the mandibles until we have considered the structure of the mouth in general; but we may remark in this place that they cannot be moved independently of each other, but only together, and that the distinction between a pars manducatoria and a pars palpigera, which is observable in most Arachnida, does not exist in Ricinulei.

The Palpi (Pl. VII., figs. 1 b, p, and 1 o; several figures on Pl. VIII. and IX.) present a structure which is quite unique amongst Arachnida. They consist of two trochanterial parts, one femoral, one tibial, and one extremely small tarsal part. The first trochanterial part of the palpus is short, almost pyriform, and admits of no movement relatively to the mandible except upwards-outwards and downwards-inwards, but this movement is not performed in a straight, but in a rather arched line. The second trochanterial part is somewhat compressed, the posterior (lower) portion being expanded, and it can be moved relatively to the first trochanterial part in a somewhat slanting direction forwards and backwards; when it is extended backwards as far as possible the corner of the posterior expansion touches the first trochanterial part. When viewed from the outside the transversal line of contact between the second trochanterial and the femoral parts is quite straight, and the connecting membrane is not visible from the outside; the relative movement between these two parts consists in a rotating movement of the femoral part round its own longitudinal axis to the extent of nearly 180° —a feature of which we know no other example in Arachnida or indeed Condylopoda of

any kind. The femoral part is always stout, though not equally so in all species; it is always stouter in adult specimens than in young animals (compare Pl. VIII., fig. 3*d* with fig. 3*e*). In shape it is but slightly compressed or not at all, and a greater or smaller part of its distal portion presents a longitudinal excavation of the ventral surface. The tibial part of the palpus is more than half as long again as the femoral part, and at the same time much less stout; it is cylindrical, but of somewhat different shape in different species; it can be—and is in reality often found—bent inwards along and close to the ventral surface of the femoral part. On its ventral surface, close to its distal extremity, it carries a small process of which the dorsal margin, at least sometimes, is distinctly serrate, and against that the tarsal part can be adduced, so that together they form a small chela. The tarsal part is always very small, but at the same time always considerably larger than the process on the tibial part; like the tibial part it is capable of movement only in the plane of the limb, that is to say, of flexion and extension.

In so far as the palpus in Ricinulei terminates in a small chela it may be said to present some similarity to the same appendage in Thelyphonoidæ. But otherwise it is, as we have already pointed out, very different from what appears in all other Arachnida, chiefly on account of the remarkable torsion between the second trochanterial and the femoral parts. By this means the animal is enabled to direct the end of the palpus both forwards and backwards, as we have shown in Pl. VII., fig. 1*b*, where we have represented one of the two palpi in each of the opposite positions. On account of the movability in the two first articulations the palpus is able to reach the mouth with its end, in either of these positions.

As regards the number of joints in the palpi, Ricinulei do not differ from other orders of Arachnida except Acari¹; the number being five in them all; and it would be quite natural to suppose, as indeed has been done, that these five joints represent the same sequence of homological equivalents in all cases. But this would be an error, as may perhaps be proved in the clearest manner by comparing the palpus in Ricinulei with that in Araneæ. In both orders the basal joint of the palpus is trochanterial, and the last tarsal, but whilst the second part in Ricinulei is trochanterial like the first, and the third is femoral, the second joint in the palpus of Araneæ is femoral, and the third a patellar part.

3. The *walking Limbs or Legs* are in several respects rather peculiar. As we have mentioned already, the three first pairs of coxae are immovably coalesced, whilst the fourth pair is free and capable of a limited rolling movement forwards and backwards, a combination which is unique amongst Arachnida². In describing the mechanism of the coupling together of the abdomen and the thorax we have pointed out the correlation between this arrangement and the movability of the fourth pair of coxae. As in Uropygi the proximal extremity of the first pair of coxae (Pl. VII., fig. 1*c*; Pl. IX., fig. 3*b*) commences at a point considerably nearer the side of the thorax than the proximal extremities of the second, third, and fourth pairs; but the fact that the coxae of each of these pairs touch one another in the middle, so as to render the sternum altogether invisible, constitutes a difference between Ricinulei and Pedipalpi, though these latter, as is well known, differ amongst themselves in this respect. On the under surface of the first pair of coxae there is near the anterior

¹ In Palpigradi (*Kœnenia*) this pair of limbs consists of eight joints besides the coxa, but in this order it is not a palpus, but a walking limb or leg.

² Compare what we have said above (pp. 27, 28) about the movability of the legs in Arachnida generally.

margin, a small, excavated place (Pl. VII., fig. 1 c), in which the stout distal extremity of the first trochanterial part of the palpus rests when drawn in towards the body.

Karsch and Thorell have already demonstrated that all the legs have both patella and tibia, and that whilst the first and second pairs have one trochanter, two such are found in the third and fourth pairs of legs. It is only in Solifugæ that we find something analogous to this last-mentioned structure, the first and second pairs of legs in Solifugæ having, as is well known, two trochanters, whilst the third and fourth have three. It is true that in Opiliones a second trochanter is often found in the legs, but this is never movable as against the femur. The direction of the movement between the coxa and the first trochanter is essentially horizontal; that between the first and the second trochanter (on the 3rd and 4th pair of legs) rather slantingly horizontal, that between patella and tibia purely horizontal; but the movement between the second trochanter and the femur, between the femur and patella, between tibia and metatarsus, and between the latter and the tarsus, consists of simple flexion and extension in the plane of the limb.

The legs are entirely destitute of aculei; not even spurs at the end of the metatarsus or the tarsal joints are found. The second pair of legs is always a good deal longer than the others; the fourth pair is but little longer than the third; the first pair is always the shortest.

The normal numbers of tarsal joints are, one on the first pair of legs, but four on the third pair, and five on the second and fourth pairs of legs. It will, however, be shown below that this does not hold good for all stages of development. In treating of the external sexual differences we shall describe the peculiar development of the metatarsus and tarsus of the third pair in the males. In the second pair of legs, the first three joints are shorter than the fourth and the fifth, and their relative lengths afford a generic character; in the third pair of legs (in females), the first three joints are very short and much shorter than the terminal joint; the same is the case with the first four joints of the fourth pair of legs. Both in *Cryptostemma* and in *Cryptocellus* all the legs carry two claws, which are quite simple, without teeth; pseudonychium and scopula are altogether wanting. The end of the foot on which the claws are placed is deeply excavated, and the margin of the excavation is on all the legs emarginate underneath; the latter is also the case on the upper side on the last two pairs of legs, particularly in *Cryptocellus*. The result of this arrangement is that the claws are very "retractile"; when drawn in they are less easily noticed on the first two pair of legs than on the others.

6. The Mouth.

(Pl. VII., figs. 1 k—1 n.)

The mouth is formed exclusively by the mandibles and the labrum, the arrangement resembling that in Uropygi.

As shown in Pl. VII., figs. 1 k and 1 m, the projecting part of the fused mandibles has the shape of a trough, open above, which projects considerably more in advance of the labrum than is the case in Oxopoei. Along the anterior margin of the mandibles and on their upper

concave surface there is a close covering of long, delicate blood-hairs¹, which are slightly plumose all round. Referring to our fig. 1 *m*, we interpret the whole middle portion as the labrum divided into two parts, which we describe as *pars apicalis* (*e*) and *pars basalis* (*f*). Across the entire middle of fig. 1 *m* a straight line (*l*) will be noticed, from which the soft membranous skin which extends to the antennæ and the posterior extremity of the cucullus *apparently* starts. In front of this transverse line the projecting portion of the mandibles is seen as well as the whole of the *pars apicalis* (*e*) of the labrum and a short portion of the *pars basalis*, which portion is considerably broader than long. It will be noticed also that the dorsal surface of each of the mandibles is continued far behind the transverse line, nearly parallel to each other, their posterior extremities being rounded, and finally that *pars basalis* *labri* is continued behind the transverse line rather farther back than the mandibles in the shape of a somewhat convex plate, which is likewise rounded at its posterior extremity. *Pars apicalis* of the labrum fulfils the ordinary functions of a labrum, its anterior and lateral margins being free and limiting the oral orifice; its integuments are everywhere thin, and its upper surface, at any rate, is covered with numerous rather long hairs; we have not been able to obtain certain knowledge of its lower surface, but so much is certain, that this part does not contain any muscles. The dorsal surface of *pars basalis* is, on the contrary, firmly chitinised, naked, and, through the whole of its length, fused with the dorsal part of the mandibles. Besides, the *pars basalis* contains a well-developed set of muscles which we shall presently describe. In the cavity of the mouth, that is the space between the mandibles and the *pars apicalis* of the labrum, the whole of the bottom and the side walls, consequently the whole of the surface of the mandibles, is covered with hairs which are directed forwards and towards the middle of the cavity. These are very different from those that cover the upper surface of the mandibles, being short, and placed so closely together in regular lines that the surface where they grow assumes the same appearance as the line-ornamentation on the back of many watches. As shown in fig. 1 *k* and particularly in fig. 1 *l* a transverse chitinous crest originates from the lower side of the plate which is formed by the mandibles and the *pars basalis* of the labrum; this crest (*c*) has the back concave, whilst its ventral margin is bent a little forward, and it is perforated by the oesophagus (*d*). We have noticed five sets of muscles in this region, viz. 1. and 2., the muscles (Pl. VII., figs. 1 *n* and 1 *k*, *m*¹ and *m*²) which move the first trochanterial part of the palpi, and which arise partly from the dorsal side of the mandibles, partly from the anterior face of the chitinous crest (*c*) just mentioned, and the dorsal side of the hindmost part of the mandibles, 3. (*m*³, fig. 1 *k*) the pumping muscle of the oesophagus or pharynx, which arises from the *pars basalis* of the labrum behind the transversal crest, 4., a muscle (*m*⁴ in fig. 1 *n*) attached to the base of the *pars apicalis* of the labrum, which probably serves to move the latter; finally 5., a muscle (*m*⁵, fig. 1 *n*) situated in the middle line, of which the function is doubtful to us.

Any doubt as to the correctness of our view, that the whole middle portion of the piece figured Pl. VII., fig. 1 *m* is to be looked upon as formed by the labrum, will be removed by comparing the structure we have described in *Cryptostemma* with that found in *Uropygi*; the similarity as regards the labrum and the dorsal portion of the mandibles being very striking. Both in *Oxopoei* and in *Tartarides* the labrum consists of a *pars apicalis*, characterised

¹ On this term see p. 124, at the top. This is at any rate the character of all the hairs which we have had an opportunity of examining against the light—without having

any chitinous wall as background—but we do not know of what kind the hairs are on the upper surface of the labrum.

by their integuments, a covering of long hairs, and the absence of muscles, whilst a *pars basalis*, which contains a complicated set of muscles, is firmly united to the mandibles, and together with the latter *apparently* is continued backwards into the head of the animal behind the thin membranous skin which extends upwards and encloses the antennæ. Although the mandibles and the *pars basalis* of the labrum are firmly united together, there is no difficulty in distinguishing them as separate pieces. The principal differences between the structure of the mouth in *Cryptostemma* and that in *Uropygi* appear to be that, in the latter, only about one half of the *pars basalis* is as it were "inside," and that a triangular process, in which the mandibles terminate, reaches laterally much further back than the *pars basalis*. Thanks to the larger size of *Thelyphonus* we have been able to ascertain how this appearance of the basal portions of the labrum and the mandibles being located inside the head comes about. As in the case of the antennæ we were able to show that it originates from a folding of the skin. This skin is membranous above the posterior end of the labrum and the mandibles; it turns forward, lying very close to the dorsal surface of the "inner" part of the labrum and mandibles, and reaching in front to that place—the transverse line (*l*)—where it suddenly turns upwards to the antennæ. We were able to introduce a fine scalpel—with the end rather blunt—between the hard upper surface of the labrum and mandibles and this membranaceous skin without injuring the latter. We have already mentioned that as regards *Cryptostemma* we have had opportunity of dissecting only one, and that a rather small specimen, and on it we have not been able to manage the same operation; but we have not the smallest doubt of the structure being the same, in that genus, as in *Thelyphonus*. The chitinous crest which extends downwards from the inside of the dorsal integument of the labrum in *Cryptostemma* does not exist in *Uropygi*.

Whilst the dorsal surface of the parts of the mouth is essentially alike in *Cryptostemma* and in *Uropygi*, their ventral surface exhibits greater differences. In the first place the mandibles in *Thelyphonus* reach somewhat further back on the ventral than on the dorsal side, whilst in *Cryptostemma* (Pl. VII., figs. 1 *k* and 1 *l*) they reach much further back on the dorsal side than on the ventral; in the next place the mandibles in *Uropygi* are without the posterior prolongation which in *Cryptostemma* (Pl. VIII., fig. 4 *b*) extends above the second pair of coxae; the consequence of the last-mentioned fact is that the piece formed by the coalescence of the mandibles and the labrum is capable of much more extensive and freer movement in *Uropygi* than in *Cryptostemma*.

It has indeed been stated by previous writers that the mandibles in *Cryptostemma* coalesce with the coxae of the legs. But it is quite certain both that this is not the case and that the mandibles together with the labrum collectively are capable of some movement, viz. a kind of swing by which the anterior extremity of the mandibles is moved a little up and down. The axis on which the parts turn is a horizontal line drawn across the broadest part of the mandibles, that is, on the upper side just in front of the place of insertion of the pair of long tendons of *m⁶* (Pl. VII., fig. 1 *k*) which terminate the upper pair of muscles. Contraction of these muscles must raise the anterior end of the mandibles towards the antennæ, whilst the opposite movement is effected by that pair of muscles (fig. 1 *k*, *m⁷*) of which the long tendons are attached to the posterior extremity of the ventral surface of the mandibles.

One more fact must be mentioned which clearly points to a close relationship between Ricinulei and Pedipalpi, especially *Uropygi*. In Amblypygi the mandibles are, as is well known, unconnected with each other, and movable independently of each other. It is

therefore quite natural that we should here find a labium sternale¹, which is firmly chitinized, long, and, except at the base itself, very narrow; when the mandibles are closed the labium forms the bottom of the mouth, as it generally does where it exists, and the narrow part of the labium is then seen as a narrow band between the mandibles. At the distal end of this narrow portion of the labium two rather long and stiff setæ are inserted, and along the sides there is a row of such, which are shorter, less stiff, and at the same time slant forwards and a very little upwards. In Oxopoei the mandibles are firmly joined together approximately from their base almost to their distal ends, leaving absolutely no room for a labium sternale; but the cephalic portion of the sternum projects between the bases of the mandibles in the shape of a short triangle, on the dorsal side of which near the anterior end several setæ are inserted so high up that their place of insertion cannot be seen from the outside; they are hidden in the groove which marks the boundary between the mandibles. Three of them are of considerable length, the longest of these reaching as far as the anterior end of the groove in which they lie, that is to say, farther forward than even the apical labial setæ in Phrynidæ. In Tartarides the structure is the same as in Oxopoei, except that the number of very long labial setæ, at least in the species known to us, is restricted to two. In Ricinulei—at any rate in *Cryptostemma crassipalpe*, the only species of which we have been enabled to dissect a specimen, and without dissection the labial setæ are very difficult to discover—the sternum does not project between the bases of the mandibles, but nevertheless three long setæ are present also here, placed on the dorsal side of the sternum near its anterior margin and hidden in the groove along the line of junction of the mandibles; they reach forward almost as far as the mandibles. We have pictured these setæ in fig. 1c on Pl. VII., but must add that this figure so far does not represent the natural condition in that we have drawn the setæ (*l*) as divergent, whereas in reality they lie so close together that they seem to be but one. We are ignorant of the function of these labial setæ in Uropygi and Ricinulei, but we cannot but think that the agreement between the two divisions in this respect indicates a certain degree of kinship.

We hope that our figs. 1c and 1m will convey to the reader a clear idea of the mutual position of the antennæ and the parts of the mouth, when it is borne in mind that in fig. 1c the antennæ have been removed from their place in the front (or upper) portion of the now empty space, and that in the posterior portion of the same space the mandibles have similarly been removed; in fig. 1m the antennæ have likewise been removed from their place close up to the concave trough-like surface of the mandibles.

In concluding this chapter we are tempted to say, that from a scientific point of view it is rather fortunate that the group of Ricinulei was so little known down to the last decennium of the 19th century, and particularly during the time when zoologists generally were fully convinced that the Arachnida were nearly allied to Insects—an opinion which perhaps is not yet quite abandoned, but which has been productive of much confusion in the view taken of Arachnida generally. It is extremely probable that, if the Ricinulei had then already been more known, the superficial *similarity* which exists between the cephalic end of the body with the mouth in that order, and the corresponding parts in Insects, would have served to confirm the opinions ruling during the period in question. In very many, perhaps

¹ See Kraepelin, figs. 1—3. Kraepelin describes the labium sternale under the curious name of "Sternalstachel" or sternal spine.

most, handbooks we find the first pair of limbs in Arachnida mentioned as mandibles, in entire disregard of the view propounded by Latreille, Claparède, and Huxley, and by them founded on comparative considerations of anatomy and embryology, viz. that the first pair of limbs in Arachnida is the homologue of the antennæ (rather of one of the two pairs of antennæ) in other Condylopoda. Authors who held the view that those limbs are mandibles would scarcely have failed to lay stress on the apparent similarity in the structure of the mouth in Ricinulei and in Insects, as a decisive argument in favour of looking upon Arachnida as being nearly allied to Insects. The cucullus which covers the supposed mandibles would have been considered the homologue of the labrum in Insects (in fact Westwood did describe it as labrum, and Karsch named it clypeus), and a point of agreement between the two classes as to the structure of the mouth would have been found in the fact that according to their view the mouth was closed below, in both these classes, by a pair of limbs of which the basal joints had coalesced into one plate whilst the following joints formed a pair of palpi.

7. *Organs of Sense.*

All the known species are entirely blind. If eyes had existed in these animals they would have been placed on the cucullus, but this part lacks every vestige of such organs.

Our material for dissection was, as we have had occasion to mention more than once, limited to one not full-grown specimen of *Cryptostemma crassipalpe*, but this we have carefully examined with a view to the discovery of such organs of sense, other than eyes—as are known, particularly through the researches of Hansen (*b*), to exist in other orders of Arachnida. One of the antennæ, one of the hindmost legs, and the abdomen were especially examined for this purpose, after being cleansed by means of caustic potash. We did not, however, succeed in finding here any of the so-called "lyriform organs," though these occur in all Pedipalpi, both Amblypygi and the two tribes of Uropygi, on the antennæ, the other limbs, the cephalothorax and on all or almost all plates of the abdomen, and have been discovered likewise in all other orders of Arachnida except Palpigradi. The examination of *Cryptostemma* in this respect offered considerable difficulty on account of the peculiar sculpture and the covering of squamiform hairs, but we are confident of the correctness of our result, that these organs do not occur in *Cryptostemma*. These Arachnida are likewise quite destitute of those long, thin, tactile hairs, inserted in calicles, which Hansen has shown to exist in the walking legs of Pedipalpi, and which besides are found on the large chelæ of Scorpiones and Chelonethi, on one of the pairs of legs in Palpigradi, and on the walking limbs of Araneæ.

At the same time we found on the upper surface of the last tarsal joint in each of the three hindmost legs a very remarkable hair placed in the middle line, which we take to be an organ of touch; and it should be noted that we found it in *Cryptocellus* as well as in *Cryptostemma*. On the two hindmost pairs of legs we found this tactile hair (Pl. VII., fig. 1 *v, s*) at a rather short distance from the terminal margin of the tarsus, which is sinuate in the middle; on the second pair of legs it is placed somewhat farther from the margin. This hair is comparatively rather short (the specimen we have drawn has a length of about 0·038 mm.), cylindrical, slightly clavate, being a little thicker at the apex; the two distal thirds of its length are furnished all over with scattered delicate branches, which are longer on the thicker terminal part; but the almost semiglobular apex itself is bald. The

hair stands in a small depression, and the surface of the skin round the latter shows a peculiar sculpture with irregular cones, processes flattened down against the surface, and some very small styliform hairs. The small area in which this tactile hair is placed is of markedly different appearance from the surrounding skin, which in *Cryptostemma crassipalpe* is closely covered with exceedingly small, pointed, almost dentiform granules. On our figure will be noticed, besides, two of the spatulate hairs (*h*), which occur in small number scattered over the body and limbs. Other organs of sense than the tactile hairs just described we have been unable to discover.

8. *Organs of Respiration.*

Only one pair of spiracles is found in these Arachnida, and this solitary pair is placed on the cephalothorax. As it would be natural to expect such spiracles as they might possess to be placed on the abdomen we may expressly state that we have examined the abdomen with great care, especially in order to ascertain whether any spiracles existed there, but we have neither found any such in the skin, nor been able to discover any trachea inside the abdomen which could be traced to an origin on the abdomen.

It was precisely in the last-mentioned manner that we succeeded in finding the spiracles on the cephalothorax, which are otherwise not easily discovered. We noticed the tracheæ at an early stage of our investigations, some of them protruding from the bases of a detached antenna and a leg which had been torn off; we followed up this observation by taking out and examining the whole contents of the middle portion and of one side of the cephalothorax, whereby several bundles of tracheæ and one of the two main trunks were found. This gave us the clue to the whereabouts of the spiracle, whereupon we cut out that portion of the integument on the other side of the cephalothorax, where we concluded the spiracle to be situated, and examined it in connexion with the contents of the same side of the cephalothorax which we had left undisturbed at first. In this way we found the spiracle together with the trunk-trachea belonging to it and the minor tubes originating from it.

The spiracles are situated near the posterior extremity of the cephalothorax, on the small triangular piece of strongly-chitinized integument which is seen inside the lateral border of the cephalothorax above the distal portion of the third pair of coxae, consequently a trifle outside and in advance of the fore end of the soft lateral skin of the abdominal peduncle. They are therefore not visible on the intact animal. Through lack of adult specimens for dissection we are unable to give a more detailed description of the structure of the spiracles, but must confine ourselves to the statement that the spiracles are rather small, and in shape like a half-moon of which the concavity turns half to the outside, half upwards. The walls, particularly near the opening, are furnished with short, extremely thick, slightly-branching hairs (Pl. VII., fig. 1 *y*), which almost have the character of processes, and at least in part are free of each other. The short trunk-trachea (Pl. VII., fig. 1 *x*) which originates from the spiracle is of a rather peculiar shape. The transverse section of the basal portion is semilunar, that of the apical portion is almost circular, and the transition from the one to the other is rather sudden. Taken all together the trachea has the form of a bag, less than twice as long as it is broad, and of which the outer and upper side is deeply depressed, over a little more than its basal half, so as to fit it to the semilunar spiracle. The trunk extends forwards in the cephalothorax, whilst numerous—doubtless several hundred—minor

tracheæ branch off from its extreme end, and from that side which turns inwards and downwards. These minor tubes do not ramify and their width is uniform in the whole of their length, but they are not all equally wide, the diameter of the widest being quite twice that of the narrowest. Those tubes which start from the end of the trunk go exclusively to the cephalothorax and the limbs, whilst those which rise from the side go to the abdomen, at least for the most part. The chitinous membrane of the basal half of the trunk is furnished with numerous rather short and very narrow, irregular, and not very distinct thicker lines, which are mostly transverse, and not connected so as to form a network; the membrane of the apical half of the trunk and along that side where the minor tubes take their rise, is closely sprinkled with thickened points so as to produce a finely granular appearance. In the membrane of the minor tubes we have not been able to discover any vestiges of any kind of thickening.

The number and position of spiracles in Arachnida generally is not a little varying. Special organs of respiration are wanting in Palpigradi (*Kænenia*) and in Acari atracheati. The abdomen alone carries spiracles in Scorpiones (four pairs), in Chelonethi (two pairs), in Pedipalpi (two pairs, generally, but in Tartarides, according to our own investigations (*b*), only one pair), and in Araneæ (two pairs, of which the hindmost pair, in Araneæ tristictæ Berth., is fused into one spiracle); furthermore in the majority of Opiliones (one pair), and amongst Acari in Ixodidæ (one pair situated behind the fourth pair of coxae). Solifugæ have spiracles both on the abdomen and on the cephalothorax (the head), whilst the family Phalangiodidæ, amongst Opiliones Palpatores, have two spiracles on each walking limb, besides the ordinary pair on the abdomen¹. It was hitherto only within the order of Acari that examples were known of spiracles existing only on the cephalothorax². From the foregoing it will be seen that this is the case in Ricinulei. We have mentioned the position of the spiracles in Arachnida generally, partly in order to point out how great the differences are in this respect within the class, but partly also in order to show that, apart from Acari, which in so many respects are polymorphous, the arrangement of the spiracles is almost constant within each order by itself. The difference existing between Ricinulei and Pedipalpi in this matter must therefore be looked upon as rather essential.—McLeod (p. 30) states: "Enfin, la position des stigmates indique également une nature différente: chez les insectes et les myriopodes, les stigmates sont situés au-dessus de l'insertion des membres, du côté dorsal, tandis que les stigmates des Arachnides sont, comme les orifices des poumons, situés à la face ventrale." As the treatises of McLeod on the organs of respiration in Arachnida are much consulted we will not omit to point out that this statement is untenable. Because even if the spiracles in Insects could be justly described as dorsal—which is very doubtful—they cannot in a general way be said to be ventral in Arachnida. The pair of spiracles situated on the cephalothorax of Solifugæ cannot be described as occupying a ventral position as regards the limbs; in Ricinulei the solitary pair of spiracles is decidedly placed above the limbs; nor is the position of the only pair of spiracles occurring in Ixodidæ a ventral one, as they are

¹ See Hansen (*b*, pp. 198—204). According to Loman (*e*) the spiracles on the walking limbs are not developed in quite young animals, but make their appearance in a later stage of development.

² This seems to be the case in Acari tracheati, with the exception of Ixodidæ and Notostigmata. As we have not ourselves made any extensive study of Acari, our statements

as to the state of things in most of these animals rest on the authority of other writers, and chiefly that of Kramer (p. 219), Michael (*a*, p. 50), and With (p. 156). According to these authors the spiracles (whether one or more pairs) are placed exclusively on the cephalothorax in Prostigmata Kram., Oribatidæ, Gamasidæ and *Myobia*.

situated in the soft lateral part of the body, consequently higher than the coxae of the limbs; and the case of those Acari (Prostigmata Kramer) whose spiracles are placed close together above the bases of the antennæ (mandibles of most writers), has not been present to the mind of McLeod on this occasion. The four pairs of spiracles in Notostigmata are all dorsal (With).

Whilst the difference between Ricinulei and Pedipalpi in regard to the position of the spiracles appears to us essential, we do not consider that the difference between them in respect of the respiratory organs is of any great weight. In our opinion the respiratory organs in Arachnida belong to two different types. One of these is found in Solifugæ (see Kittary, pp. 343—353), Opiliones, and, amongst Acari, in Ixodidæ and Notostigmata, viz. richly-ramified tracheæ, with distinct spiral thickening. The other type occurs in Chelonethi (see Croneberg, pp. 445, 446), Ricinulei, Araneæ, and apparently in the majority of Acari tracheati¹, viz. tracheæ of which the thickenings are not spiral but linear annular, or replaced by mere thicker points, and which are either slightly or not at all ramified, or else in bundles from the trunks. We agree with Leuckart and several other writers² in looking upon the so-called lungs in Scorpions, Pedipalpi and Araneæ as mere modifications of the tracheæ of the second type. Apart from the order of Acari, which in so many respects exhibit so much variety, it must be admitted that the two kinds of tracheæ which we look upon as constituting the two types, do not occur within the same order or in nearly allied orders of Arachnida, but slightly ramified or tuft-shaped tracheæ of the second type are found in nearly allied orders, or even within one and the same order, and the difference in this respect is consequently of less importance. Within the limits of Araneæ it is well known that Araneæ theraphosæ Sim. and *Hypochilus* have (see Simon *e*, pp. 6, 7) two pairs of so-called lungs, whilst the other Araneæ vere have one pair of lungs and one pair of tuft-shaped or slightly ramified tracheæ (according to Bertkau). According to an investigation by Bertkau, first published very briefly by Thorell, and later on at greater length by Simon (*e*, Vol. I. pp. 326, 327), the family Caponiidæ, comprising the genera *Nops* MacLeay, *Caponia* E. S., and *Caponina* E. S., shows a very interesting exception to this rule. The figures of Bertkau, published by Simon, enable the reader to form a good judgment on the structure in question. A strong trachea showing some few ramifications originates from the second pair of spiracles; from the first pair of spiracles arise a pair of respiratory organs which, in Simon's own words, are "des trachées qui consistent en un tronc principal, court, qui donne naissance à des fines ramifications en forme de buissons." We may add that this first pair of respiratory organs in Caponiidæ presents a considerable resemblance to the single pair of organs in Ricinulei, yet with the difference that the stem from which the tracheal tubes originate is much larger in Ricinulei than in Caponiidæ. The fact that Ricinulei and Caponiidæ possess only tracheæ, whilst Thelyphonoidæ, Amblypygi, Araneæ theraphosæ and *Hypochilus* have only lungs, but the great majority of Araneæ possesses both forms of organs, proves therefore that no great weight can be attributed to this difference.

¹ According to the statements of authors whose investigations must be looked upon as fully trustworthy, such is at any rate the case in Oribatidae (Michael, *a*, pp. 168—176), Bdellidæ (Michael *c*, pp. 518, 519; Pl. XLIII. fig. 45), *Trombidium* (Henking, p. 565, Pl. XXXIV. fig. 7). In the last-mentioned case the absence of the spiral thickenings is, however, not specially mentioned. We have ourselves examined the tracheæ in *Ixodes*.

² According to the investigations of Jaworowsky (p. 65)

the so-called lungs in Araneæ (*Lycosa*) have at first the appearance of long, slightly-ramified tracheæ, of which the terminal portion disappears at a later stage of development, whilst the pulmonary leaves are developed in the basal portion of the tracheæ, for which reason he shares the view of Leuckart. While not omitting to mention this, we do not feel justified in attributing great weight to this observation, which, as far as we are aware, has not been corroborated by other observers.

9. *External Sexual Characters. Stages of Development.*

Of *Cryptostemma Karschii* we have had adult specimens of both sexes before us; of *C. Sjöstedtii* and *C. Westermannii* we have had an adult male and a younger female; of the genus *Cryptocellus* we have had only one specimen of each of the two species, but fortunately the male of the one species and the female of the second. Our material for a direct comparison of the sexes has therefore not been large, but it has sufficed for us to ascertain that secondary differences according to sex exist as to the equipment of the legs with processes, and in similar features of lesser weight. These secondary sexual characters vary in the different species which we have examined, and we shall therefore treat of them in our descriptions of the species.

But besides these there is a sexual difference in the structure of the metatarsus and the tarsus of the third pair of legs, which appears to be constant in the main, though differences may be noted in the smallest details. Very little has been said on this subject by Karsch (c, p. 32), and we therefore consider it proper to give as exhaustive an account of this remarkable arrangement as it certainly deserves.

The *metatarsus* of the third pair of legs in the male of *Cryptostemma* (Pl. VIII., figs. 3 a and 3 h, b) has the appearance of being much thickened, which, however, in reality is mostly due to the dorsal margins being raised in the shape of keels. Towards the middle of the joint these keels approach one another somewhat, and they are here connected by means of a transverse ridge, of which the distal face is concave. In this manner the dorsal face of the joint is divided into two hollow lodges, of which the distal one is wider and deeper than the proximal one. In *Cryptocellus* the metatarsus is much thicker, and as it were inflated (Pl. IX., figs. 3 a and 3 i), and the cavity on the dorsal face is wide and deep, but shorter than in *Cryptostemma*, nor is it divided into two lodges. In both genera a process is found (Pl. VIII., fig. 3 h, c; Pl. IX., figs. 1 h, c and 3 i, c), near the proximal extremity of the dorsal surface of the metatarsus, connected with it by means of an articulation which renders it movable. In *Cryptostemma* (Pl. IX., fig. 1 h) the process is easily seen to be placed close to the anterior side of the joint and to lie in a special excavation on the joint from which only the point protrudes, whilst in *Cryptocellus* (Pl. IX., fig. 3 i) its place is just a little in front of the middle line of the joint, nor is the process here placed in a special excavation. The process presents a double curvature, is compressed and fairly evenly pointed; much the largest—proximal—half of it is closely covered with fine hair, and in *Cryptostemma* at the same time granulated. The curved point turns backwards.

The *tarsus* of the third pair of legs in the male is distinguished by a very remarkable conformation of the two first joints, particularly of the first. The posterior dorsal margin of the second joint is raised into a high almost perpendicular plate (Pl. IX., figs. 1 h, 3 h, and 3 i, e² and e¹), which is scooped out like a spoon (our 'lamina cyathiformis'), and which varies not a little in shape. Sometimes it is formed only by the posterior margin of the joint, and in this case (Pl. IX., fig. 3 i) the excavation turns forward; in other cases the plate extends besides over the distal end of the joint, and the excavation turns towards the base and the anterior side of the joint (Pl. VIII., fig. 3 h; Pl. IX., fig. 1 h). In any case this excavation serves to receive the distal extremity of the movable process on the first tarsal joint, which we shall mention presently, and the shape of the excavation corresponds to the shape of the process. The posterior dorsal margin of the first tarsal joint is similarly raised into a plate, which, however, is lower (Pl. IX., fig. 3 h), or at its distal extremity carries a compressed conic

protuberance (Pl. IX., fig. 1 *h*, *d*¹) which fits against the proximal extremity of lamina cyathiformis. On its dorsal side, close to its base, the first tarsal joint carries a very long process (Pl. VIII., fig. 3 *h*, *d*², and Pl. IX., fig. 3 *i*, *d*²; Pl. IX., figs. 1 *k* and 1 *l*), which is very movable and divided by a kind of suture into two portions, which are not movable in relation to each other, and of which the terminal one is of a rather complicated structure. As this latter is very different in the different species, we shall in this place merely state that it is very long, strongly curved upwards, and at the same time flat or flattened, at least towards the joint. In *Cryptostemma* (Pl. IX., figs. 1 *k* and 1 *l*) the anterior margin of this piece exhibits a diverging flat process, which is absent in *Cryptocellus* (Pl. IX., fig. 3 *i*).

The tarsus is very movable and capable of being bent upwards so far that its dorsal side at least touches the dorsal side of the metatarsus. When this movement is executed in *Cryptostemma* the distal portion of lamina cyathiformis covers the proximal lodge on the dorsal side of the metatarsus like a lid, whilst the first tarsal joint and the remainder of the second tarsal joint together with the proximal portion of lamina cyathiformis, enter a little into the distal lodge on the metatarsus. The consequence is that when the tarsus in *Cryptostemma* is bent upwards it forms together with the metatarsus a closed space, within which the movable process on the first tarsal joint is wholly enclosed. In *Cryptocellus* the corresponding space is not quite closed, because in this genus lamina cyathiformis does not enter into the cavity on the dorsal side of the metatarsus, when the tarsus is bent upwards; when this movement is effected the proximal part of lamina cyathiformis touches the posterior border of the cavity, but the distal part of it projects freely above the anterior corner of the metatarsus, and the space remains open on the anterior side of the leg. In both genera the tarsus, when bent upwards, hooks on slightly to the metatarsus, by means of the curved point of the process on the metatarsus catching round the anterior border of the movable process on the first tarsal joint. In *Cryptostemma* the coupling is somewhat strengthened by the arrangement that the diverging flat process on the anterior border of the movable process of the first tarsal joint enters into that excavation on the metatarsus, in which the movable process of the latter lies, and with its own border catches round the edge of the posterior wall of the excavation. That this hooking together is the proper function of the diverging process in question as well as of the excavation is confirmed by the circumstance that both are wanting in *Cryptocellus*.

Karsch does not advance any opinion as to the function of the arrangement of the metatarsus and the tarsus of the third pair of legs in the one sex which he rightly supposes to be the male. But Cook (p. 259) indicates without hesitation, "Copulatory organs external, borne by the third (penultimate) pair of legs." We must agree with this view, because it is not reasonable to suppose an arrangement so complicated to be without a definite function; nor is it an instrument for catching hold of the female. We must therefore note that this contrivance cannot possibly be looked upon as intended to convey liquid semen, as is the case with the copulatory organs of the male in Araneæ. It does not seem therefore that one has any choice but to assume that the movable process of the first tarsal joint (supported by lamina cyathiformis on the second joint) serves the transfer of spermatophores; but whether that is so can of course be decided only by making out the occurrence of spermatophores by an anatomical investigation of adult animals, or still better by observing the act of copulation in living animals. In this connexion we may call to mind that spermatophores have been discovered in other Arachnida. We have

not only Michael's description (*b*, pp. 294—296) of the remarkable manner in which the male in Gamasinæ forms and by means of antennæ transfers the spermatophore, but the investigations of Birula¹ render it "probable" that in Solifugæ the copulation is likewise carried out by means of spermatophores.

Differences according to Age. We have already mentioned that the large sternites of the third, fourth, fifth, and sixth segments are distinct in young animals, but coalesce in the adults, as also that the portions of soft skin which intervene between the firm portions of the large tergites of the fourth, fifth, and sixth segments are noticeable in adults only as extremely narrow strips, whilst they are comparatively large in the young. In the smallest of our specimens of *Cryptostemma Sjöstedtii*, their length (the distance between their anterior and posterior margins) was equal to that of the second tergite. There is also a difference in colour, the young animals (often exhibiting a dirty yellow tint) being much lighter in colour than the adults, which in the great majority of species are dark reddish-brown or nearly black. *Cryptocellus Simonis* being a good deal brighter coloured than the other species, we must state that the young are easily distinguished from the adults by the distal end of the tibial part of the palpi, which is considerably darker than all the rest of the palpus in the young, whilst the whole palpus is uniformly coloured in the adults. A comparison between Pl. VIII., fig. 3 *d*, which represents the palpus of an adult male, and fig. 3 *e* which represents the palpus of our smallest specimen of the same species, shows that the palpus of the adults is stouter, and much more richly granulated than in the young animal, and also that the shape of the tibial part is somewhat different.

In nearly full-grown specimens the number of tarsal joints is the same as in the adults², viz. 1, 5, 4, 5; but in our smallest specimen of *Cryptostemma Sjöstedtii*, which measured 4·2 mm. in length, whilst the adult male measured 6·9 mm., the numbers of the tarsal joints were 1, 4, 3, 2 (Pl. VIII., figs. 3 *m* and 3 *l*); in a small specimen of *Cryptostemma crassipalpe*, measuring 2·7 mm. in length (we do not know the adult of this species), the numbers were 1, 5, 4, 4. From this it may be inferred that these animals moult at least three times.

10. *The systematic Position of the Family Cryptostemmatoidæ and of the Order Ricinulei.*

The majority of earlier writers on the genus *Cryptostemma* (or the family of Cryptostemmatoidæ) have referred these animals to the order of Opiliones. We cannot help thinking that in so doing they must have been guided in no small measure by a certain, though not very striking, similarity between *Cryptostemma* and *Trogulus*, in the general aspect, and such points as the depressed appearance and uneven surface of the body, the relative length of

¹ We do not know Birula's treatise (*Untersuchungen über den Bau der Geschlechtsorgane bei den Galeodiden*, in *Horæ Soc. Ent. Ross.* vol. 28, 1894, pp. 283—326) except through the extract given by Stadelmann in *Archiv f. Naturgeschichte*, Jahrg. 61, II. 1895, p. 53.

² The two specimens we had of *Cryptostemma Afzelii*

showed only one tarsal joint on one leg of the fourth pair; in one specimen this was the case with the left leg of that pair, in the other it was the right leg. The joint in question was furnished with its usual two claws, which were well developed, and it was similar in shape to the tarsal joint on the first pair of legs.

the legs amongst themselves and in proportion to the body, etc. From our investigation of the structure of this type, the results of which we have given in the preceding pages, we are able to assert, with far more assurance than Karsch (*c*), that the classification of Cryptostemmatoidæ amongst Opiliones is not tenable. The only points of agreement between Cryptostemmatoidæ and Opiliones of any weight are these two, that the number of abdominal segments is nearly the same, and that the walking limbs in both possess both patella and tibia—a character which is well-known to occur in several other orders. That Cryptostemmatoidæ agree with Opiliones in having tracheæ (not "lungs") is, in our estimation, not a point which brings them together systematically, because we consider that the tracheæ of these two divisions belong to different types, as we have explained above (p. 133). The fact that Cryptostemmatoidæ possess a cucullus constitutes to a certain degree a similarity between that family and a single family of Opiliones, namely Troguloidæ; and in estimating the importance of this fact it should be borne in mind that the genus *Anelasmococephalus* does not possess the prolongations of the ocular protuberance which occur in the other Troguloidæ.

It cannot be denied that our account of the anatomy of Cryptostemmatoidæ discloses considerable agreement in several respects with the order Pedipalpi, particularly with the sub-order Uropygi, and as the difference—especially in the structure of the mouth—between the latter and the other sub-order of Pedipalpi, viz. Amblypygi, is not inconsiderable, no objection could be raised against placing Cryptostemmatoidæ amongst Pedipalpi, founded merely on the fact that the uniformity of the order of Pedipalpi would thereby be disturbed. But we must maintain that some of the considerations which militate against such a course are too strong to be disregarded. We would particularly insist on the following points.

1°. The abdomen consists in Pedipalpi of 12 segments whilst in Cryptostemmatoidæ there are only 9; nor would it in our opinion essentially alter the matter even if later investigation should prove the existence of a further, anterior segment, either in the adult or the embryo of the Cryptostemmatoidæ. It is true that in the first portion of this paper we have succeeded in explaining and accounting for the apparently great difference which exists between the different divisions of Opiliones in respect of the number of abdominal segments, by showing which tergites or, particularly, sternites are absent where the number is reduced. But we are able to state with certainty that such an explanation will in the future be impossible in the case of Pedipalpi and Cryptostemmatoidæ, because in both these groups the tergites and sternites of each segment correspond to each other as regards their position in such a manner that it is evident that no tergite is present without its corresponding sternite or vice versa. We note that the coalescence of the second and third tergites in Cryptostemmatoidæ does not make any difference in this respect, and besides that we have had enough young specimens of Cryptostemmatoidæ at our disposal to know that there is no question of any coalescences of entire segments.

2°. The remarkable and peculiar development of the metatarsus and the tarsus in the males of Cryptostemmatoidæ, which indicates a peculiar form of copulation.

3°. The fact that in Cryptostemmatoidæ the spiracles are placed on the cephalothorax, whilst they are placed on the abdomen in Pedipalpi.

4°. In Cryptostemmatoidæ the first pair of legs are developed for walking whilst in Pedipalpi they serve as organs of touch.

5°. The foremost portion of the cephalothorax is in Cryptostemmatoïdæ developed into a movable plate, the cucullus, which covers the antennæ and the dorsal side of the mandibles, whilst in Uropygi it is coalesced with the rest of the cephalothorax, and only covers the basal portion of the antennæ and the dorsal side of the mandibles.

Other features characteristic of Cryptostemmatoïdæ are (*a*) the remarkable mechanism for coupling together the cephalothorax and the abdomen, (*b*) the peculiar structure of the palpi, and (*c*) the fact that the two hindmost pairs of legs have two trochanters (as also the palpi), whilst the two foremost pairs of legs have only one trochanter.

In consideration of these distinguishing features we are of the opinion that Cryptostemmatoïdæ must constitute a separate order next to Pedipalpi, and for this order the proper name will be Ricinulei, which was used by Thorell as early as 1876.

The systematic position of Cryptostemmatoïdæ has been touched upon lately by Cook (p. 259), who in his analytical table of the sub-classes and orders of Arachnida (apart from Acari) places the Cryptostemmatoïdæ in his sub-class Podogona, as a separate order to which he gives the name of Rhignogastra, but of which he does not mention the characters. The distinguishing character of Podogona is given by Cook as "copulatory organs external, borne by the third (penultimate) pair of legs"; and to this sub-class he also refers the "order" Meridogastra Thor. (Anthracomarti Karsch), though not without doubt. In so far as Cryptostemmatoïdæ, according to Cook's classification, occupy a place near the sub-class Pedipalpi, there is an apparent similarity between Cook's view and our own, though it must not be overlooked that he appears to consider Pedipalpi to be more nearly related to Holosomata (Opiliones and Pseudoscorpiones). But in reality this similarity is quite superficial, because it is only through the application of purely negative characters for connecting these groups that Cryptostemmatoïdæ and Pedipalpi happen to occupy places near each other in Cook's system; and it is due moreover to an erroneous supposition on his part. The only one of these negative characters¹ which is susceptible of being converted into a positive statement is this: "Thoracic stigmata wanting"; but, as we have shown, it is precisely on the cephalothorax that the spiracles are placed in Cryptostemmatoïdæ. Had Cook been acquainted with this fact his method of grouping the orders would have led him to place them near Solifugæ, of which one of the distinguishing characters is "Thoracic stigmata present." It must be held that the *whole* arrangement of Cook, as given in his analytical table, is open to very serious objection on account of it being founded on little more than negative characters.

Although it will necessarily occupy not a little space we think it worth while to discuss in some detail the view of Karsch, who in his paper on *Cryptostemma* (*c*, pp. 29, 30) refers that genus to the family Poliocheridæ Scudd., the group Ricinulei Thor., and the order Meridogastra Thor. (Anthracomarti Karsch). The historical facts are as follows.

In 1882 Karsch described (*a*) a fossil Arachnidan from the Coal-formation under the name of *Anthracomartus Völkelianus* n. gen. and sp. At the same time he proposed a new family, Architarboidæ, to which he referred his new genus as well as *Architarbus* Scudd. with three fossil species. Finally Karsch proposed a new order, Anthracomarti, to comprise besides Architarboidæ another new family Eophrynoidæ, founded on *Eophrynus Prestwicci* (Buckl.). The diagnosis of Anthracomarti is as follows: "Körperstamm 2 Segmentenkomplexe formirend;

¹ The other characters are: "Without paired abdominal [spinning-] organs; palpi of males not utilized as copulatory organs"; but this is only tantamount to saying that these animals are not Araneæ.

Vorderleib ungegliedert, Hinterleib gegliedert; Palpen von oben her sichtbar" (The body divided into two groups of segments; the anterior portion of the body not jointed; the posterior portion jointed; the palpi visible from above). The insufficiency of this definition, which would fit most of the orders already proposed containing recent forms, needs no demonstration. It may be added that Karsch refers another genus from the Coal-formation, *Kreischeria* Gein., to the family Troguloidæ which belongs to the order Opiliones; but this genus is decidedly not properly placed amongst Troguloidæ; and we doubt very much whether it belongs to Opiliones at all.

In 1885 Scudder proposed a classification (*a*) of the palæozoic Arachnida known at the time; he adopted the order Anthracomarti Karsch, added new genera and species, and divided it into four families: Arthrolycosidæ Harg. (which only comprises the genus *Arthrolycosa* Harg.), Poliocheridæ (containing only *Poliochera* Scudd.), Architarboidæ Karsch (comprising *Architarbus* Scudd. with the species *A. rotundatus* Scudd., *A. subovalis* Woodw. and *A. silesiacus* Roem.; *Anthracomartus* Karsch and *Geraphrynum* Scudd.), and finally Eophrynoïdæ Karsch (*Kreischeria* Gein. and *Eophrynum* Woodward). In 1890 the same author published a work accompanied by a series of illustrations (*c*) in which he does not alter his former account of the order Anthracomarti, but only treats of two out of the four families he had proposed, viz. Poliocheridæ and Architarboidæ, which latter he augments by a new genus. His diagnosis of the order, which does not differ in any essential point from the one he gave in 1885, is as follows: "Body somewhat depressed, the cephalothorax and abdomen distinctly separable. Cephalothorax usually made up in large part of more or less wedge-shaped pedigerous segments, the arrangement of which corresponds to that of the coxae. Abdomen forming a single mass and composed of from four to nine distinct joints. Palpi not much longer than the legs and simply terminated." As regards the systematic position of the order he says: "Its position seems to be between the Chelonethi and the Pedipalpi, to the latter of which it bears perhaps the closest relations." But everyone who is tolerably acquainted with the structure of the skeleton in most orders of Arachnids, must be very dissatisfied with a diagnosis of such a quality. It is not only that it is decidedly too jejune and vague, but the statement that the cephalothorax "usually" is composed of segments corresponding to the coxae commands so much the less confidence, as it is distinctly irreconcilable with a series of representations of these animals published by Scudder himself and earlier authors. Finally one cannot avoid asking why Scudder assumes that the palpi are without claw or chela, since on the specimens of which figures have been published the palpi are as a rule so badly preserved that the point cannot be decided at all; in most cases the palpi are absent, and when they are present their termination seems to be absent, except in the case of *Eophrynum Prestwichii* (v. Scudder, *b*, p. 737), which appears to possess a claw of considerable size. There are other difficulties which render one sceptical. Thus Scudder depicts what he describes as three specimens of *Geraphrynum carbonarius* (*c*, Pl. XL., figs. 1, 10 and 12), but there is no possibility of these three specimens belonging to one and the same species; they belong to at least two different genera, perhaps even to different families or orders.

It was also in 1890 that Haase published a paper in which he treats in considerable detail of "the 'Anthracomarti,'" submitting all the genera and species which had been referred to that order before 1890 to a critical examination. His paper is extremely interesting as illustrating the great uncertainty attending the interpretation of the fossil remains which had been referred to Anthracomarti. Amongst the genera which Scudder (*b*) had placed in the

family Arthrolycosidæ Harg., Haase refers *Arthrolycosa* itself to Aranæ, which is doubtless correct, whilst, with some doubt, he places *Rakovnicia* Kusta—which Scudder had referred to Arthrolycosidæ—amongst Chelonethi. In the opinion of Thorell, expressed in 1891 (*g*, p. 9, note 1), this genus ought to be referred to Aranæ. *Poliochera* Scudd. was known to Haase only from a short description, but he places it quite correctly at the side of the recent *Cryptostemma*, which he knew only from the account of Gervais; at the same time Haase, though not without doubt, brings *Poliochera* to the family Troglloidæ (of the order Opiliones). In so doing he was in accord with the view of all earlier writers on *Cryptostemma*, but the preceding pages show how far this piece of classification was from being fortunate. Amongst the Architarboidæ Haase refers *Architarbus rotundatus* Scudd. and the genus *Geraphrynus* Scudd. to Amblypygi, but in view of the illustrations in Scudder's later work (*c*) this must appear very doubtful as regards the majority of the species. We have already stated that the three specimens, which Scudder figures as belonging to *Geraphrynus carbonarius*, belong to as many different species, and of these only one, the one figured on Pl. XL., fig. 12, can, with any certainty, be classed amongst Amblypygi¹. Another species of *Architarbus*, viz. *A. subovalis* Westw., Haase erects into a new genus, a new family and a new sub-order of Opiliones, which he names Phalangiotarbi. For the genus *Anthracomartus* itself he proposes the family of Anthracomartidæ. He divides the family Eophrynidæ into two: Kreischeriidæ and Eophrynidæ, and he proposes a further new sub-order of Opiliones, viz. Anthracomarti, to comprise the three families just mentioned. The establishment of these two sub-orders and the reference of them to the Opiliones is, in our opinion, quite unproved and therefore unwarranted. Guided by our own pretty intimate knowledge of the structure of the dermoskeleton in all recent families of Opiliones, we consider that the figures of those fossil remains, which Haase proposes to place among Opiliones, exhibit several important peculiarities, which differ widely from what is known to exist in the recent species, but of which the systematic value cannot as yet be appreciated; besides which it must be insisted upon that the fossil remains are so incomplete as regards important parts, such as limbs including antennæ and the parts of the mouth, that it is simply impossible on them to base a really well-founded opinion concerning their relationship either to Opiliones or to any other orders. We believe that, though Haase is fully or partially right in referring some members of the order of Anthracomarti to recent orders, his proposals in this direction are in other cases erroneous, or at any rate for the present not capable of justification. But so much must be admitted, and deserves to be noted, that he has proved the order of Anthracomarti, whether in the sense of Karsch or in that of Scudder, to be composed of utterly heterogeneous elements.

Now as regards Karsch's idea of placing *Cryptostemma* in the family Poliocheridæ Scudd. under the order Meridogastra Thor.² we have to make the following observations. The figure of *Poliochera punctulata*, published in 1890 by Scudder (*c*), who had described the species in 1885, represents the dorsal surface of a fortunately tolerably well preserved specimen and, to judge from the details which can be ascertained with reasonable certainty, we are unable to

¹ The abdomen exhibits a striking agreement with the ventral surface of *Phryinus*, showing amongst other points eleven distinct sternites of exactly the same shape as those in *Phryinus*, where the ventral plate of the first of the twelve abdominal segments is hardly to be seen. The mandibles, which fortunately are preserved, differ in nothing from those of *Phryinus*. Behind them only three pairs of coxae are seen, just as in *Phryinus*, where the first pair of coxae are scarcely

visible when the animal is seen vertically from below. It is true that Scudder indicates seven joints in the mutilated palpi, but his counting is probably not more correct than in the case of the abdominal segments of which he only counts nine.

² This name had been proposed by Thorell, in 1885, instead of Anthracomarti.

point out any character indicating a generic difference between *Poliochera* and *Cryptostemma*. Nevertheless, we would not on that account propose to cancel the genus *Poliochera* and regard the name as synonymous with *Cryptostemma*; because it is quite possible that the animal figured by Scudder may possess generic characters different from those of *Cryptostemma*, which are not visible on his figure, but which may be ascertained in the future, perhaps by means of better preserved specimens. Besides, it does not seem probable to us that one and the same genus (according to the modern acceptation of this term) has existed both in the period of the Coal-formation and now. Whilst therefore *Poliochera* may be retained as a genus, though a new diagnosis is at least a desideratum, the family cannot retain the name Poliocheridae, which only dates from 1885, but must either bear the name Cryptostemmidæ, which was employed by Westwood as early as 1874, or that which, for linguistic reasons, we ourselves prefer, Cryptostemmatoidæ.

There remains the question whether Cryptostemmatoidæ can properly be referred to the order Meridogastra (Anthracomarti). In this respect we must note first of all that the number of abdominal segments is a most important character for a series of orders of recent Arachnida. In the *recent* *Cryptostemma* our predecessors had discovered only four abdominal segments, to which some added a segmentum anale, whereas the real number is nine. Now, if naturalists have failed to discover more than one-half of the really existing segments in the firmly chitinized dermoskeleton of such a rather large *recent* form as *Cryptostemma*, this seems to prove the impossibility of ascertaining with any accuracy the number of abdominal segments in the great majority of fossil Arachnida. In *Phrynus* there are twelve segments, but the first sternite is scarcely visible, and that the difficulty of counting them sometimes is great may be concluded from the fact that Scudder states the number of segments in the specimen of *Geraphrynus carbonarius* which is represented in his fig. 12, to be nine, whereas the figure plainly shows eleven sternites. It will likewise in most cases be impossible to ascertain correctly the number of joints in the antennæ; the structure of the limbs and of the mouth—all of which offer characters of the greatest systematic importance for the definition of the orders. Finally, it is doubtless, as already mentioned, owing only to a certain similarity to *Trogulus* in the general appearance, that hitherto all writers excepting Karsch have placed *Cryptostemma* amongst Opiliones, although differing in structure as much as possible from that order. These considerations seem to prove the necessity of exercising the greatest caution both in referring fossil Arachnida to orders founded on recent animals (unless the similarity between the fossil and the recent animal is very striking indeed) and in founding new orders on fossil Arachnida. If possible even greater circumspection is required in placing a recent animal in an order of Arachnida founded on fossil remains, because this may turn out, as it has happened with Meridogastra, to consist of really quite heterogeneous elements; the reference of a recent animal to such an order may be tantamount to not classing it at all.

We are of opinion that there is no possibility of proving Cryptostemmatoidæ (*Poliochera* included) to be as nearly related to any fossil form referred to the Meridogastra (Anthracomarti), as to the sub-order Uropygi (the existence of which in the Coal period has indeed been demonstrated with certainty long ago); and, as said above, we believe that Cryptostemmatoidæ ought to constitute an order apart. We have already shortly indicated our view as regards Haase's proposals for classing the other elements of Meridogastra with other orders; and we hold that all those which cannot with reasonable certainty be placed in the orders founded on now living Arachnida, ought to be left standing by themselves as genera (and species), of which the systematic position is as yet unknown. The order Meridogastra ought therefore to disappear

from the system, at least for the present, until zoologists have obtained a correct appreciation of the different types through numerous new finds and more thorough study of them. It is probable that, whilst some of these palaeozoic Arachnida will find their places in orders founded on the now living animals, the majority will be found to constitute one or more new orders. But if these are established with undue haste, the result will only be more confusion.

It may be noted in this connexion that the *Geralinura*, which has been found in the Carboniferous formation of Bohemia and Illinois, is well known to be closely related to *Thelyphonus*, but that, as appears from the list given by Scudder (*b*, p. 746) and as has been stated in 1899 by Pocock (*c*, p. 216), no form belonging either to Uropygi or to Ricinulei has been found in strata belonging to the enormous interval between that palaeozoic period and the present time.

In conclusion we wish to say a few words, relating to one point, concerning that group of Orders for which we propose the name of Arachnida micrura. It is well known that the very long "tail" in Scorpiones has an important function, namely that of producing a powerful blow with the poisonous supra-anal hook, which constitutes the weapon of the animal. Similarly the short "tail" (not the flagellum, but the 10th—12th abdominal segments) of Uropygi most likely has the function of enabling the animal to direct against an attacking enemy the acid which it is capable of emitting from the two glands which open on the anal joint, because according to our investigation these glands (*b*) are also found in Tartarides. The justice of this view of the functional importance of the "tail" in Uropygi is, we think, corroborated by the fact that in Amblypygi, where the glands are absent, the "tail" is but little developed as such. Nor is it difficult to understand how it may be of value to Araneæ to possess a "tail" of about the same length as the mamillæ which are placed close by; because the position of anus at the extremity of such a "tail" prevents the mamillæ being soiled. That these are placed close together, apparently at the posterior extremity of the abdomen, is an arrangement of such evident utility as to need no further elucidation. The correctness of this view is confirmed by the fact that the length of the "tail" corresponds moderately well to the mobility and the length of the (upper) mamillæ¹, the "tail" being less developed when the mamillæ are long and rather movable; and particularly by the very striking fact that the "tail" is feebly developed in *Liphistius*², where the mamillæ—as is well known—are placed far from the posterior extremity of the abdomen. We are not able to point out the functional value of the "tail" in Palpigradi and Ricinulei; it must be different from what it is in Uropygi. But this does not diminish—in fact it rather increases—the morphological and therefore also systematic weight of this point of agreement between Pedipalpi, Palpigradi, Ricinulei and Araneæ, that they all possess a "tail" which is *typically* formed by three segments. These four orders are upon the whole closely connected with one another; one of the sub-orders of Pedipalpi, viz. Amblypygi, approaches most nearly to Araneæ, whilst the other sub-order Uropygi, exhibits a series of essential points of agreement with Palpigradi, through Tartarides, and with Ricinulei, through Oxpoei. We therefore think it expedient, before stating the characters of the order of Ricinulei, to sketch the characters of Arachnida micrura, and the main characters of the other orders of this group. We have

¹ For further remarks on this point we refer to Sörensen (*f*).

² It will be remembered that this genus, which is remarkable on account of the firmly chitinized tergites of the abdomen, was called *Liphistius* because Schiödte, who first described it, believed that it was not furnished with spinning organs. The original specimen of *L. desultor* Sch., which

is preserved in the Copenhagen Museum, has always been in so bad a condition that it is scarcely possible to distinguish the spinning organs even if one is aware of their existence. Nor, unfortunately, is it possible to decide whether the "tail," which is very indistinct, consists of one or of two segments.

already, on an earlier occasion (*a*, pp. 236, 237), at a time when we had not yet studied Ricinulei, stated that Pedipalpi is the central one of this series of orders, and our subsequent investigation of Ricinulei has corroborated the correctness of that appreciation.

Some authors seem to think that *Kœnenia* may be placed amongst Pedipalpi—an idea which is probably due to the similarity in appearance between it and Thelyphonoidæ. We would therefore expressly point out that Palpigradi (*Kœnenia*) is the one of those four orders which is the farthest from Pedipalpi; amongst the families of the latter order Palpigradi approaches most to Tartarides; but not nearly so much as Araneæ approach to Amblypygi.

We do not propose here to discuss the question whether the order Pedipalpi ought to be maintained as such, or whether it would not be better to erect the two sub-orders which compose it, Uropygi and Amblypygi, into independent orders.

We will confine ourselves to pointing out the remarkable fact that the two groups constituting one and the same order, Pedipalpi, not only differ strongly in respect of a matter so essential as the structure of the mouth, but that one of them, the Uropygi, in this respect approaches much more closely to another order, Ricinulei, than to its own companion sub-order, the Amblypygi.

C. PARS SYSTEMATICA.

Arachnida micrura.

Tibiae pedum et plerumque palporum in patellam et tibiam divisæ.

Abdomen ad basin plus minusve constrictum.

Segmenta abdominalia postrema tria constricta, "caudulam" formant.

Organa respiratoria (si adsunt) e trunco breviore et tracheis constant, quæ simplices (*i.e.* non ramosæ) sunt et spira substitutæ sunt.

Ordines Arachnidum micrurorum secundum characteres insignissimos sic collocari possunt:

- I. Antennæ triarticulatae, chelatae. Os labro et labio tantum formatum, mandibulis destitutum, quod par secundum membrorum sunt pedes gressorii. Pedum trochanteres verticaliter et femora horizontaliter moventur. Organa respiratoria desunt. Segmenta abdominalia undecim; postremum flagello præditum *Palpigradi* Thorell
- II. Antennæ biarticulatae, leviter vel vix chelatae. Os mandibulis instructum. Pedum trochanteres horizontaliter et femora verticaliter moventur. Organa respiratoria adsunt:
 - A. Antennæ non venenosæ. Palpi prehensiles. Segmenta abdominalia duodecim; postremum appendice (operculo anali aut stylo aut flagello) præditum. Organa respiratoria brevia: tracheæ sunt sacci compressi, segmentis abdominalibus secundo et (plerumque) tertio impositi. *Pedipalpi* Latr.
 - B. Antennæ venenosæ. Palpi palpantes. Segmenta abdominalia duodecim (plerumque obsoleta). Organa respiratoria aut brevia tracheis sacciformibus, compressis, aut longiora tubuliformia (plerumque: et sacciformia et tubuliformia), segmentis abdominalibus secundo et (si determinari potest, ad quod segmentum par posterius pertineat) tertio imposta. Organa copulationis maris articulo ultimo palporum imposta. Organa nendi adsunt: mamillæ ventrales (2—8) abdominalis *Araneæ* Sundevall
 - C. Antennæ non venenosæ, chelatae. Palpi prehensiles, chelati. Segmenta abdominalia novem, prioribus duobus brevibus. Organa respiratoria sunt tracheæ longissimæ, e trunco (sacco) brevi orientes. Organa sine dubio copulatoria tarso III maris imposta *Ricinulei* Thor.

Ordo: RICINULEI.

1892. Ordo: Meridogastra (Thorell) p.p.¹ Karsch ('Berl. Ent. Zeitschr.', Vol. xxviii., pp. 143—146).
 1892. Subordo (Opilionum): Ricinulei Thorell ('Bih. t. K. Svenska Vetensk. Akad. Handl.', Stockholm', Vol. xvii., 4, No. 9).
 1899. Rhignogastra (Subclassis Podogonum) Cook ('Proc. Ent. Soc. Washington', Vol. iv., p. 259).

Antennæ biarticulatæ, leviter chelatae.

Os labro transversim bipartito et mandibulis formatum. Mandibulae secundum lineam medium corporis coalitæ, itaque inter se immobiles. Pars basalis labri cornea cum mandibulis coalita. Pars apicalis labri submembranacea sola mobilis, qua de causa os motu hujus partis solius aperitur et clauditur. Mandibulae et labrum simul sumpta mobiliora.

Palpi mandibulares in articulos quinos divisi: partes trochantericas duas, femoralem, tibialem, tarsalem. Pars femoralis usque ad 180° converti potest. Pars tarsalis parva et processus minutus partis tibialis chelam parvam formant.

Setæ supra apicem anteriorem sterni positæ, longissimæ paucæ (tres) in sulco, mandibulis formato, jacentes (itaque difficillimæ visu) apicem mandibularum fere attingunt.

Pedum coxae I recedentes et II et III immobiles, secum coalite; IV mobiles. Pedes trochanteribus I et II singulis, III et IV binis instructi. Trochanteres horizontaliter et femora verticaliter moventur. Tibiae in patellam et tibiam divisæ.

Cephalothoracis pars anterior exserta, mobilis, laminam magnam format, antennas et os, quasi eucullum, obtegentem.

Abdomen sat late pedunculatum, in segmenta novem divisum, quorum priora duo brevia, difficilia visu; sequentia quattuor magna; posteriora tria parva caudulam formantia.

Abdomen cephalothoraci et coxis IV mecanismo peculiari adstrictum.

Organæ respiratoria trachealia. Tracheæ e trunco (sacco) brevi et amplio oriuntur, simplices (non ramosæ) longissimæ, spira non instructæ. Spiracula duo lateribus cephalothoracis imposita, supra partem ulteriorem coxarum III. Spiracula abdominalia nulla.

Copulationem sexualem ope spermatophorarum fieri putamus, quæ processu mobili, articulo primo tarsi III imposito, transferantur. (Suspiciuntur verba Britannica pp. 134, 135.)

Differentia sexualis structura peculiari metatarsi et tarsi III maris itaque facillime demonstratur. (Structura viscerum, tracheis exceptis, incognita.)

Animalia (viventia) adhuc cognita hujus ordinis omnia ad unam familiam pertinent.—Si ordo aliquis unam tantum familiam habet, difficile est, characteres ordinis et characteres familie discernere. Quod hac in re conantes, rationem characterum familiarium (tribuum) ordinis affinis Pedipalporum duximus.

Familia: CRYPTOSTEMMATOIDÆ.

1874. Cryptostemmidæ Westwood ('Thesaurus Ent. Oxoniensis', p. 210).
 1892. Cryptostemmoidæ Thorell ('Bih. t. K. Svenska Vet.-Akad. Handl.', Vol. xvii., 4, No. 9, p. 9).
 1892. Poliocheridæ (Scudd.) Karsch ('Berl. Ent. Zeitschr.', Vol. xxviii., p. 30).

Oculi desunt.

Antennarum articulus prior processu ventrali, cuius acies dentibus serrata est (et altero processu minore dorsuali interdum) instructus. Articulus secundus robuste unguiformis, introrsum flectitur et processu ventrali articuli prioris adjuvante secat.

Mandibulae processu anteriore manducatorio destitutæ.

¹ Pro certo habemus, saltem nonnulla animalia fossilia ordinis Meridogastrorum Cryptostemmatoidis affinia esse. Cognitio autem horum animalium fossilium adhuc exigua prohibet, quominus haec animalia systematice distribuere conari audeamus. Eadem de causa censemus nomen Ricinuleorum, quamquam recentius, nomini Meridogastrorum præferendum esse, quum de animalibus etiam nunc viventibus mentio fiat.

Sternum angustissimum nisi dissectione inconspicuum.

Tarsi I non partitus; in articulos divisi: II 5, III 4, IV 5. Tarsi unguiculis binis instructi, fundo excavationis apicalis magnæ impositis, valde retractilibus. Pseudonychium deest.

Segmenta ventralia magna apud animalia adulta in scutum coalita.

Caudulæ segmenta parva; ultimum et penultimum modo tubi telescopici retractilia.

Metamorphosis: pulli minores articulos tarsales 1, 4, 3, 2; pulli majores 1, 5, 4, 4; animalia immatura jam 1, 5, 4, 5 habent. Segmenta ventralia pullorum et animalium immaturorum libera.

Pars ulterior partis tibialis palporum pullorum et animalium immaturorum manifesto saturatior quam pars citerior.

Explicatio terminorum nonnullorum.

“*Angulus submedius*” cephalothoracis est: angulus parvus lateralis dorsi, aduersus intervallum inter coxas II et III positus.

“*Antennæ*” sunt: membra primi paris, quæ auctores plurimi mandibulas appellant.

“*Aree laterales*” segmentorum abdominalium dorsualium sunt: partes laterales segmentorum quarti, quinti, sexti, plerumque tertii, a parte media segmenti cùte molliore in animalibus adultis angusta, in junioribus lata, separatæ.

“*Cucullus*” Thor. est: pars prima cephalothoracis, laminam mobilem formans, antennas et dorsum mandibularum obtegentem.

“*Lamina cyathiformis*” maris est: crista marginis posterioris (interdum etiam apicis) articuli tarsalis secundi pedum III, processum mobilem articuli primi amplectens.

“*Mandibule*” sunt: membra secundi paris, quæ auctores maxillas appellant.

“*Sulci laterales*” cuculli sunt: sulci margini suo quisque laterali subparalleli;—“*marginales*” cephalothoracis: parti anteriori marginum lateralium paralleli;—“*transversus anterior*” cephalothoracis: sulcus (si adest) brevis, transverso posteriori parallelus et sulco medio conjunctus;—“*transversus posterior*” cephalothoracis: margini posteriori cephalothoracis parallelus et propinquus.

“*Procurvam*” appellamus lineam ante concavam; “*recurvam*” lineam pone concavam; “*sursum curvatum*” pedem vel articulum supra concavum.

Longitudo corporis ab articulatione cuculli ad marginem posteriorem segmenti sexti (magnorum ultimi) sumitur; cephalothoracis ab articulatione cuculli ad cristam subperpendicularem, quæ margo posterior cephalothoracis esse videtur; abdominis a margine posteriore sulci transversi (Tab. IX., fig. 1f') plerumque obiecti ad marginem posteriorem segmenti sexti (magnorum ultimi).

Genera et species.

Species octo cognitæ in genera duo¹ jam constituta sibi propinqua, *Cryptostemmatis* Guér. Africæ centralis indigenæ et *Cryptocelli* Westw. Americæ meridionalis indigenæ, distribuendæ sunt.

Conspectus generum.

Antennarum artculus primus processibus subapicalibus duobus prædictus, processu majore ad summum dimidio longiore quam latoire. Pedum II artculus tarsalis quartus articulo quinto saltem parte tertia longior 1. *Cryptostemma* Guér.

Antennarum artculus primus processu subapicali unico, saltem pæne duplo longiore quam latoire prædictus. Pedum II artculus tarsalis quartus articulo quinto non longior . 2. *Cryptocellus* Westw.

¹ Præter quæ genus extinctum *Poliocherae* Scudd. (‘Boston Journ. Nat. Hist.’ N. Ser., vol. iv., Tab. 39, Fig. 2), quod in ætate carbonaria vixit, hanc ad familiam pertinens, generi

Cryptostemmatis peraffine esse videtur; nam a *Cryptostemmate* charactere jam indicato nullo differt.

1. CRYPTOSTEMMA Guér.

1838. *Cryptostemma* Guérin ('Rev. Zool.', p. 10).
 1844. *Cryptostemma* Gervais ('Ins. Apt.', T. III. p. 130).
 1892. *Cryptostemma* Karsch ('Berlin. Ent. Zeitschr.', vol. XXVIII., p. 30).
 1892. *Cryptostemma* Thor. ('Bih. t. K. Svenska Vet.-Akad. Handl.', vol. XVII., 4, No. 9, p. 10).

Antennarum articulus primus processibus subapicalibus duobus, inter sese valde inaequalibus praeditus; processus major ad summum dimidio longior quam ad basin latior. Articulus secundus ad latus interius versus crassior, acie interiore angusta, subito extenuata, munitus.

Cephalothoracis margo anterior plus quam dimidiā partem latitudinis maximæ efficiens.

Coxæ II diametruS basalis saltem pene æque magna atque ea coxarum III et IV simul sump-tarum, itaque multo major quam ea coxae III.

Coxarum IV margines posteriores inter se angulum valde obtusum formantes, quare pars triangula segmenti abdominalis ventralis tertii (magnorum primi) saltem triplo latior quam longior est.

Tarsus I æque longus atque crassus.

Tarsi II articulus quartus saltem parte tertia longior quam quintus.

Tarsorum III et IV margo superior apicalis leviter incisus.

Metatarsus III maris cavis dorsualibus duobus instructus, quorum anterius processum mobilem metatarsi amplectitur; cavum alterum multo majus, in alveos duos carina transversa divisum, quorum cterior lamina cyathiformi tarsi adducti quasi operculo ocluditur. Pars apicalis processus mobilis articuli tarsalis III primi processu anteriore instructa.

Species omnes Africæ centralis (occidentalis) indigenæ.

Conspectus specierum.

A. Dorsum corporis, venter abdominis, pedes (coxis tarsisque exceptis) squamis per medium sulcatis, vestita:

I. Cucullus sine sulco medio per longitudinem ducto; squamæ corporis magnæ, latiores vel latæ.

- a. Squamæ dorsi et pedum paullo longiores quam latiores. Sulci laterales cuculli desunt. Palporum pars femoralis non duplo longior quam crassior 1. *C. crassipalpe* n. sp.
- b. Squamæ dorsi et pedum circiter duplo longiores quam latiores. Sulci laterales cuculli mani-festi. Palporum pars femoralis paullo plus duplo longior quam crassior. 2. *C. plebejum* n. sp.

II. Cucullus sulco medio per longitudinem ducto praeditus; squamæ corporis parvæ, angustæ. 3. *C. Westermanni* Guér.

B. Corpus et pedes squamis destituta, pilis autem teretibus praedita:

I. Femora supra sulcata. Pili pedum grana, densa et inter se ubique æqualia, vix superantes. Sulci laterales cuculli sat profundi. (Species magna) 4. *C. Afzelii* Thor.

II. Femora supra non sulcata. Pili pedum saltem ex parte majore duplo et in metatarsis partim plus duplo longiores quam grana, minus densa et inter se, saltem in femoribus, inæqualia. Sulci laterales cuculli levissimi vel nulli. (Species minores):

- a. Cucullus manifesto brevior quam ad basin latior, ultra medium paullo plus tertia parte latior quam ad basin. In mare margines inferiores tibiae I processibus singulis praediti; femur II (ut in femina) solum ad apicem paullo crassius quam femur I 5. *C. Sjöstedtii* n. sp.
- b. Cucullus perpaullo longior quam ad basin latior, ultra medium plus dimidio latior quam ad basin. In mare tibia I aliquantum incrassata, processibus destituta; femur II ad medium plus duplo crassius quam femur I 6. *C. Karschii* n. sp.

1. *Cryptostemma crassipalpe* n. sp.

Tab. VII., figg. 1 a—1 y.

Animal immaturum 4·8 mm. longum; dorsum corporis et venter abdominis et pedes squamis paullo longioribus quam latioribus sat dense vestita et granis parvis vel minutis praedita; sulcus medius cephalothoracis sat latus, in sulcum transversum anteriorem perbrevem pone desinens; intra angulum submedium sulcus sat levis, semicircularis adest; cucullus sulcis destitutus, paullo longior quam ad basin latior, ultra medium $\frac{2}{3}$ latior quam ad basin; palporum pars femoralis squamosa, non duplo longior quam crassior et pars tibialis prope basin plus dimidio crassior quam ultra medium et aliquanto crassior quam ad apicem; femora supra non sulcata.

Cephalothorax æque latus atque longus, granis parvis rubro-violaceis sat densis et post sulcum transversum posteriorem granis minutis densis ornatus. Squamis pallentibus paullo longioribus quam latioribus sat densis pili clavati breviores immixti sunt. Margo lateralis ante angulum submedium sat profunde emarginatus. Sulcus medius sat latus, partem paullo plus quam dimidiam cephalothoracis explens, in sulcum transversum anteriorem perbrevem desinens; sulcus transversus posterior levis; sulcus marginalis manifestus; intra angulum submedium sulcus sat levis, semicircularis adest.

Cucillus paullo longior quam ad basin latior, ultra medium $\frac{2}{3}$ latior quam ad basin et dimidio latior quam longior; margo anterior non emarginatus; sulci laterales desunt. Granula parva et squamae sat densa; pili acuti ante adsunt.

Abdomen. Grana et squamae et pili clavati ut eadem cephalothoracis. Granula ventralia pusilla, multo minora quam dorsalia, posteriora versus non majora. Squamis segmentorum ventralium densis pili clavati sat parce immixti. Impressiones musculares dorsuales leviores, ventrales evanidae. Mandibulae et coxae pilis haud squamiformibus ornatae; granula mandibularum majora quam coxalia, quæ minora sunt quam ventralia.

Antennarum processus major articuli primi dimidio longior quam ad basin latior; acies dentibus quattuor triangulis armata, quorum ultimus aliquanto major quam reliqui. Acies dimidia articuli secundi dentibus octo munita.

Mandibulae simul sumptae duplo latiores quam longiores; margo anterior profunde emarginatus et deorsum haud leviter inclinus.—Palporum pars trochanterica prior dense granulata et pilis parce praedita. Pars trochanterica secunda in parte dorsuali anteriore laevis, ceterum dense granulata et pilis anguste squamiformibus parce praedita. Pars femoralis non duplo longior quam crassior, deorsum leviter curvata, inconspicue granulata; squamae dorsuales multo latiores quam ventrales. Pars tibialis prope basin plus dimidio crassior quam ultra medium et aliquanto crassior quam ad apicem; pars ulterior non dimidia granulis oblongis ornata; pili minus densi, basales dorsuales sat late squamosi, ceteri apicem articuli versus sensim angustiores et longiores, ita ut ulteriores teretes et acuti sint.

Pedum articuli omnes subtiliter rubro-granulati, granulis apicem versus pedis paullo minoribus. Tarsi pilis teretibus et squamis angustis, articuli ceteri ceteri squamis latis densis ornati. Diametru basalis (sive interior) coxae II manifesto, non autem dimidio major quam diametru coxarum III et IV simul sumptarum. Femora in dorso non sulcata; II perpaullo crassius et pæne $\frac{2}{3}$ longius quam I. Tibiae subrectæ, supra non sulcatæ; I duplo longior quam crassior. Metatarsi omnes sursum leviter curvati; I æque crassus atque apex tibiae. Tarsi II articulus quartus plus duplo longior quam tertius et vix dimidio longior quam quintus.

Color animalis immaturi fulvo-testaceus, partibus ulterioribus duabus partis tibialis palporum brunneis.

Speciminis majoris long. corp. 4·8 mm.; long. et lat. cephalothor. 1·8 mm.; long. abd. 3 mm.; palpi 2·6 mm.; pedes I 3; II 5·4; III 3·7; IV 3·9 mm.—Specimen minus, cuius articuli tarsi IV quattuor, 2·7 mm. longum.

Patria: Africa centralis occidentalis. Specimina duo, alterum immaturum et alterum fere pullum, vidimus, in Kamerun a cl. Yngve Sjöstedt collecta, in Museo Holmiensi asservata.

2. *Cryptostemma plebejum* n. sp.

Tab. VII., figg. 2a—2f.

Animal immaturum 7.5 mm. longum; dorsum corporis et venter abdominis et pedes squamis, quarum plurimae saltem duplo longiores quam latiores, sat dense vestita et granis sat parvis predata; sulcus medius cephalothoracis pone profundus sulco transverso anteriori brevi conjunctus; inter angulos submedios et sulcum medium sulci obliqui bini adsunt, secum angulum rectum formantes; cucullus sulcis lateralibus manifestis ornatus, paullulo brevior quam ad basin latior, ultra medium haud dimidio latior quam ad basin; palporum pars femoralis squamosa, paullo plus duplo longior quam crassior et pars tibialis prope basin perpaullo crassior quam ultra medium et quam ad apicem; femora supra late sulcata.

Cephalothorax manifesto latior quam longior, granis sat parvis et humilibus dense praeditus. Squamæ densæ, plurimæ saltem duplo longiores quam latiores. Margo lateralis ante angulum submedium emarginatus. Suleus medius partem pene dimidiā cephalothoracis exprens sat latus, pone sensim profundior, sulco transverso anteriori brevi conjunctus; sulcus transversus posterior in medio levis, in lateribus profundior; sulci marginales sat profundi. In parte posteriore sulci utrinque singuli y-formes adsunt, quorum levissimus ramus, posterior, sulcum transversum posteriorem attingit, et exterior marginem lateralem ante angulum submedium attingit, et interior, ceteris latior et profundior, post finem anteriorem sulci medii desinit.

Cucullus paullulo brevior quam ad basin latior, ultra medium dimidio latior quam longior; margo anterior levissime emarginatus; sulci laterales manifesti. Granula parva, sat densa; squamæ densæ; pili immixti pone rari et breves, leviter claviformes, antrorsum sensim densiores et longiores, ita ut primores acuti et densi sint.

Abdomen. Granula dorsi minora et latius separata quam grana cephalothoracis; posteriora versus non minora. Squamæ dorsi densissimæ, plurimæ saltem duplo longiores quam latiores. Granula ventralia minima densa, multo minora quam dorsalia, posteriora versus non majora. Squamæ ventrales densissimæ, duplo longiores quam latiores. Squamis dorsi et ventris sat parce immixti sunt pili leviter claviformes, squamis haud multo breviores. Impressiones musculares dorsi et ventris manifestæ. Granula mandibularum et coxarum II paullulo, coxarum III et IV non majora quam ventralia abdominis.

Antennarum processus major articuli primi dentibus (præter apicalem) quatuor armatus, apicem versus articuli majoribus. Articuli secundi pars media fere tertia dentibus munita; (in antenna dextra dentes sex, in sinistra novem inventi sunt.)

Palporum pars trochanterica prior partim granulata, pilis teretibus paucis ornata. Pars trochanterica secunda granulata, pilis deplanatis parce praedita. Pars femoralis paulo plus duplo longior quam crassior, leviter curvata, squamis et inferioribus¹ pilis teretibus acutis ornata, quarum squamarum dorsuales circiter triplo longiores quam latiores sunt. Pars tibialis prope basin perpaullo crassior quam ultra medium; ad apicem vix incrassatum granulata; pili densi adsunt, basales sat anguste squamosi, apicem versus articuli angustiores et longiores, ita ut ulteriores teretes et acuti sint.

Pedes, tarsis exceptis, minus dense granulati et squamis densis ornati, quibus pili pauci inferiores subteretes immixti sunt. DiametruS basalis (sive interior) coxae II paullo major quam diametruS coxarum III et IV simul sumptuarum. Femora omnia in dorso late sulcata; II duplo longius et paullo crassius quam I. Tibiae rectæ, II supra sat leviter, ceteræ levissime vel non sulcatae; I (saltem in feminâ immatura) plus duplo longior quam crassior. Metatarsi I et II sursum levissime curvati; I minus crassus quam apex tibiae. Tarsi II articulus quartus plus duplo longior quam tertius et parte tertia longior quam quintus.

Color feminae immatura sordide fusco-testaceus, ventre paullo fusciore quam dorso abdominis. Pars anterior dimidia partis tibialis palporum brunnea.

Long. corp. 7.5 mm.; cephaloth. long. 2.4 mm., lat. 2.7 mm.; long. abd. 5.1 mm.; palpi 4.4 mm.; pedes I 5.5; II 10.2; III 6.3; IV 7.2 mm.

Patria: Africa centralis, Germanica septentrionali-occidentalis. Specimen unicum immaturum vidimus, quam feminam habemus, ad pagum Togo mense Junii a cl. E. Baumann collectum, in Museo Berolinensi asservatum.

¹ In partibus femorali et tibiali pili a dorso ad latus ventrale versus angustiores.

3. *Cryptostemma Westermannii* Guér.

Tab. VII., figg. 3a—3b; Tab. VIII., figg. 1a—1f.

Mas 8·4 mm. longus, brunneo-ferrugineus; dorsum corporis et venter abdominis et pedes squamis, circiter triplo longioribus quam latioribus, et granis magnis sat densis praedita; sulcus medius cephalothoracis profundus, ante evanescens, marginem anteriorem cephalothoracis attingens; sulcus transversus anterior deest; inter angulos submedios et sulcum medium sulci obliqui bini adsunt, secum angulum rectum formantes; cucullus sulcis lateralibus manifestis et medio leví ornatus, paulo longior quam ad basin latior, ultra medium haud dimidio latior quam longior; palporum pars femoralis squamosa perpaullo plus duplo longior quam crassior et pars tibialis prope basin et apicem perpaullo crassior quam ultra medium; femora supra anguste sulkata. In mare tibia I processibus destituta; femur II dimidio crassius quam I.

1838. *Cryptostemma Westermannii* Guérin-Méneville ('Revue Zoologique', p. 11).1838. *Cryptostemma Westermannii* Id. (Opus nobis incognitum: 'Dict. pitt. d'hist. nat.', Tab. 539, fig. 7).1844. *Cryptostemma Westermannii* Gervais (in: Walckenaér, 'Hist. nat. Ins. Apt.', T. III, p. 131, Tab. 47, figg. 4, 4a).

Cephalothorax paullulo latior quam longior, granis magnis densis et squamis parvis angustis minus densis praeditus. Squamæ circiter triplo longiores quam latiores, paulo breviores quam diametrum granorum. Margo lateralis ante angulum submedium late emarginatus. Sulcus medius marginem anteriorem cephalothoracis attingens; pars anterior evanescens (quamquam lata) itaque minus manifesta, pars cetera profunda posteriora versus semper profundior, pone vix dilatata. Sulcus transversus posterior manifestus; transversus anterior deest; marginales profundi. In parte posteriore cephalothoracis sulci utrinque singuli y-formes adsunt, quorum ramus levissimus, posterior, sulcum transversum posteriorem attingit, et exterior sulcum marginalem attingit, et interior, ceteris latior et profundior, post finem anteriorem partis profundioris sulci medii desinit.

Cucullus paulo longior quam ad basin latior, ultra medium haud dimidio latior quam longior; margo anterior levissime emarginatus; sulci laterales manifesti; sulcus medius levis, ante evanescens, longitudinem circiter dimidiæ cueilli exprens. Grana multo minora quam in cephalothorace, ante altiora; squamæ densiores quam in cephalothorace; pili acuti densi ante adsunt.

Abdomen. Areae laterales dorsi (animalis adulti) difficiles visu¹. Grana dorsi minora quam in cephalothorace; grana segmentorum quinti (magnorum tertii) et imprimis sexti manifesto minora quam grana segmenti quarti. Squamæ dorsuales densæ, ventrales densissimæ. Grana ventralia parva, posteriora versus majora. (Grana dorsi et ventris granula inconspicua immixta sunt; squamis abdominis pili clavati pauci immixti sunt.) Impressiones musculares profundæ et, imprimis dorsuales, longæ. Grana in mandibulis et coxis II majora quam in coxis III et IV, ubi majora sunt quam grana ventralia anteriora abdominis.

Antennarum processus major articuli primi dentibus (præter apicem) quattuor armatus. Articuli secundi pars media dentibus humilibus rotundatis munita.

Palporum partes trochantericae granis et pilis teretibus ornatæ. Pars femoralis granulis fere inconspicuis et squamis angustis et inferioribus pilis teretibus acutis praedita; perpaullo ultra duplo longior quam crassior, sat curvata. Pars tibialis prope basin et prope apicem perpaullo crassior quam ultra medium; ad apicem leviter granulata; squamis perangustis, dorsualibus et lateralibus, et pilis teretibus acutis inferioribus et apicalibus ornata.

Pedes, tarsis exceptis, granis, marginalibus majoribus quam ceteris, et squamis angustis ornati. Diametrus basalis coxae II paulo brevior quam diametru coxarum III et IV simul sumptarum. Femora omnia supra anguste sulkata. Tibiae deorsum leviter curvatae; II supra anguste, ceteræ non sulkatae. Tarsi II articulus quartus duplo longior quam tertius et dimidio longior quam quintus.

Differentia sexualis: Femina adulta incognita. Femur II dimidio longius et dimidio (in specimine juniore paulo) crassius quam I. Tibia I circiter duplo longior quam crassior, processibus destituta. Metatarsus III supra valde excavatus, marginibus alte extenuatis, quare vix duplo

¹ In figura, a Gervais data, non videntur.

longior quam crassior est.—Articuli tarsales III a latere inferiore inspecti: primus latior quam longior; secundus duplo longior et manifesto angustior quam primus; tertius paullulo angustior quam secundus et paullulo longior quam primus; quartus paullo longior et manifesto angustior quam tertius. Margo posterior articuli primi in processum altum productus, curvatum et basi marginis posterioris articuli secundi nitentem. Pars citerior marginis posterioris articuli secundi subrecta; laminam cyathiformem, ab apice tarsi inspectam vix ultra medium apicis articuli attingentem, incisura profunda a parte cetera apicis, angulo anteriore elevata, separat; itaque concavitas laminæ marginem anteriorem potius quam basin articuli adspicit. Processus mobilis articuli primi tarsi III: pars basalis dimidio suo brevior quam pars apicalis; processus anterior partis apicalis depresso, rectus (non falciformis), in apice oblique obtuse acuminatus; processus præcipuus in speciem laminæ formatus, oblique truncatus, dentibus inferioribus tribus (quorum unus parvus est) instructus et in apophysem perlongam, gracilem curvatam productus.

Color animalis adulti brunneo-ferrugineus, coxis dilutioribus (rufescens). Animal adolescens fulvo-ferrugineum; palpi et pedes fulvi, parte ulteriore partis tibialis palporum fusca.

Long. corp. 8·4¹ mm.; cephaloth. long. 3·2, lat. 3·4 mm.; long. abd. 5·2 mm.; palpi 5·6 mm.; pedes I 8·4; II 13·6; III 9·3; IV 9·6 mm.

Animal adolescens 7·7 mm. longum; cephaloth. long. 2·5, lat. 2·8 mm. Grana pedum minora quam in animale adulto.

Patria: Africa centralis, Germanica septentrionali-occidentalis. Specimina duo perlustravimus, ad Bismarckburg prope pagum Togo a cl. R. Buttner collecta et in Museo Berolinensi asservata; marem adultum, mense Januario, et animal junius, mense Julio captum.

De Synonymia. Descriptioni brevi *Cryptostemmatis Westermannii*, a Guérin datae et figuræ (manifesto haud accuratae) a Gervais datae (et a Guérin delineatae) animal adultum nostrum sat bene congruit. His tamen in rebus specimen nostrum differt: (1) Guérin dicit, par tertium pedum longius esse quam par quartum; secundum figuram autem par quartum longius est. (2) Impressiones (musculares) segmentorum abdominalium secundum Guérin obliquae sunt; nostro in specimine impressiones partim oblique partim sibi parallelae sunt; sed e speciebus, quarum exempla aliquot vidimus, cognovimus formam impressionum variabilem esse. (3) Secundum figuram, a Gervais datam, tibia II infra—saltem in margine anteriore—incrassata et paullo ultra medium angulate producta est. Tibia II nostri speciminis sane non eodem modo constructa est; vestigium tamen structuræ talis præbet (vide Tab. VIII., fig. 1 c): pars citerior enim paullo crassior gradu perlevi marginis inferioris et anterioris a parte ulteriore limitata est.

4. *Cryptostemma Afzelii* Thor.

Tab. VIII., figg. 2 a—2 g.

Femina circiter 10·5 mm. longa, ferrugineo-fusca, membris ferrugineo-brunneis; dorsum corporis granis magnis fere seabrum; sulcus medius cephalothoracis sat latus et profundus sulco transverso anteriori brevi conjunctus; inter angulos submedios et sulcum medium sulci obliqui bini adsunt, secum angulum rectum formaantes; cucullus sulcis lateralibus sat profundis præditus, æque longus atque ad basin latus et ultra medium dimidio latior quam ad basin; palporum pars femoralis paulo plus duplo longior quam crassior, ubique granulata, et pars tibialis prope basin non crassior quam ultra medium, ad apicem paulo crassior; pedes granis rotundatis densis et pilis, quam granis vix altioribus, prædicti; femora supra non sulcata.

1892. *Cryptostemma Afzelii* Thor. (‘Bih. t. K. Svenska Vet.-Akad. Handl.’, vol. xvii., 4, No. 9, p. 10).

Cephalothorax perpaullo latior quam longior, granis magnis densis fere scaber. Pili granis sat numerose immixti, granis vix altiores, itaque minus conspicui. Margo lateralis ante angulum submedium sat profunde emarginatus. Sulcus medius partem saltem dimidiat cephalothoracis explens, sat profundus et latus, sulco transverso anteriori brevi conjunctus; sulcus transversus posterior manifestus; sulci marginales sat profundi; inter angulos submedios et sulcum medium sulci bini sat profundi adsunt, secum angulum rectum formantes.

¹ Si mensura animalis ex parte primori cuculli inclinati capit, specimen nostrum accurate 9 mm. longum est, i.e. æque longum ac specimen a Guérin descriptum.

Cucullus æque longus atque ad basin latus, ultra medium dimidio latior quam ad basin; margo anterior (a fronte inferiore inspectus) in medio leviter emarginatus; sulci laterales sat lati et sat profundi. Grana granis cephalothoracis manifesto minora et densiora; pili brevissimi numerosi.

Abdomen. Dorsum quoad sculpturam cephalothoraci subdissimile: elevationes leves, valde irregulares, granis ornatae, et impressiones leves inter se mixtae. Grana ventralia abdominis densa, multo minora quam dorsalia, posteriora versus paullulo majora. Impressiones musculares dorsuales et ventrales manifestae. Grana mandibularum manifesto minora quam ventralia et manifesto majora quam grana coxarum.

Antennarum processus major articuli primi dentibus triangulis quinque armatus, processus apicem versus majoribus, manifesto brevioribus quam ad basin latioribus. Acies articuli secundi prope basin levissime crenulata.

Palporum partes trochantericae, praesertim in latere anteriore, granulis dense ornatae, marginem inferiorem versus majoribus subacutis. Pars femoralis paullo plus duplo longior quam crassior. Pars tibialis recta prope basin non crassior quam ultra medium et paullo gracilior quam in parte apicali. Partes femoralis et tibialis, praesertim in latere anteriore, dense granulatae (et punctis impressis destituta) et pilis brevibus sat densis praeditæ.

Pedes, tarsis exceptis, granis rotundatis densis, sibi æqualibus ornati, manifesto humilioribus quam latioribus; pili granis immixti vix longiores quam grana. Femora omnia in dorso sulcata, I leviter; II pene plus quam dimidio longius et non parte tertia crassius quam I. Tibiae I duplo longior quam crassior; II manifesto et IV leviter per longitudinem superiore sulcate. Metatarsi I, II, IV sursum leviter curvati; I non crassior quam apex tibiae. Tarsi II articulus tertius paullo brevior quam quintus, quartus dimidio longior quam quintus.

Fuscum, ferrugineo tinctum. Membra ferrugineo-brunnea.

Long. corp. (sine cucullo) 10 mm.; long. cephalothor. 3·9 mm.; lat. cephalothor. 4·2 mm.; long. abd. 6 mm.; palpi 6·2 mm.; pedes I 9·4; II 14·5; III 10·5; IV 12·5 mm.

Patria: Sierra Leone. Feminas duas vidimus, alteram ab ill. Thorell descriptam, ab Afzelio in seculo duodecimo collectam et in Museo Holmiensi asservatam, alteram a cl. E. E. Austen collectam et in Museo Britannico asservatam.

5. *Cryptostemma Sjöstedtii* n. sp.

Tab. VIII., figg. 3 a—3 m.

7 mm. longum, fusco-rubrum aut fusco-ferrugineum; dorsum corporis granis sat magnis densis praeditum; sulcus medius cephalothoracis angustus; sulcus transversus anterior deest; intra angulum submedium impressio parva perlevis semicircularis solum adest; cucullus sulcis lateralibus levissimis praeditus, manifesto brevior quam ad basin latior, ultra medium paullo plus quam tertia parte latior quam ad basin; palporum pars femoralis paullo plus duplo longior quam crassior, infra granulata, ceterum impresso-punctata; pars tibialis prope basin paullo crassior quam ultra medium et vix crassior quam ad apicem; pedes granis minus densis et (saltem in femoribus) inæqualibus, majoribus subacutis, et pilis praediti, quorum plurimi duplo, et in metatarsis partim plus duplo, longiores sunt quam grana majora; femora supra non sulcata. In mare uterque margo inferior tibiae I processu suo instructus; femur II (ut in femina immatura) solum ad apicem paullo crassius quam femur I.

Cephalothorax perpaulllo longior quam latior, granis sat magnis densis praeditus; pili granis immixti ante sat densi et ibi granis manifesto altiores. Margo lateralis ante angulum submedium leviter emarginatus. Sulcus medius angustus, saltem ad medium, interdum fere ad marginem anteriorem cephalothoracis ductus; sulcus transversus anterior deest; transversus posterior et marginales perleves; intra angulum submedium impressio parva perlevis solum adest, semicircularis, extra concava.

Cucullus manifesto brevior quam ad basin latior, prope apicem paullo plus quam tertia parte latior quam ad basin et dimidio latior quam longior; margo anterior leviter lateque emarginatus; sulci laterales levissimi. Grana paullo minora et densiora quam grana cephalothoracis; pili anteriores sat longi.

Abdomen. Grana dorsi mediocria et minora inter se mixta, a granis cephalothoracis paullum discrepantia. Grana ventralia densa, multo minora quam dorsalia, posteriora versus manifesto majora. Impressiones musculares manifestae. Grana mandibularum et coxarum II manifesto majora quam grana coxarum III et IV et subæque magna atque grana anteriora ventralia abdominis.

Antennarum (utriusque sexus) processus major articuli primi paullo longior quam ad basin latior, dentibus brevioribus quattuor armatus. Articulus secundus dentibus sex aut septem munitus.

Palporum partes trochantericæ punctis impressis destitutæ, granis præditæ, quæ partim majora sunt quam granula partium femoralis et tibialis. Pars femoralis paullo plus duplo longior quam crassior, infra granulata, ceterum impresso-punctata; in femina immatura puncta impressa, quia pauca et parvula sunt, deesse facile putantur. Pars tibialis prope basin paullo tantum crassior quam ultra medium, ad apicem vix angustior quam prope basin; prope basin sublævis, deinde granulata, granulis apicem versus sensim majoribus.

Pedes, tarsis exceptis, granis inæqualibus prædicti: partim parvis rotundatis, partim magnis, manifesto conicis, subacutis, tamen humilioribus quam ad basin crassioribus, a sese spatio separatis, quod fere ubique multo majus est quam basis grani; in latere superiore femorum omnium et in latere inferiore femorum I et II grana maxima adsunt, in ordines binos plus minusve manifestos disposita. Pili granis immixti ex parte majore duplo longiores quam grana majora; in metatarsis partim plus duplo longiores. Coxæ II, III, IV præter grana punctis impressis subtilibus præditæ. Diametrum basalis (sive interior) coxae II major quam diametrum coxarum III et IV simul sumptarum. Femora in dorso non sulcata; II fere duplo longius et ad apicem paullo crassius quam I. Tibiae supra non sulcatæ; I, II, IV subrectæ. Metatarsi I, II, IV prope basin subito sursum leviter curvati. Tarsus I pæne duplo crassior quam apex metatarsi; tarsi II articulus quartus duplo longior quam tertius et dimidio longior quam quintus.

Differentia sexualis: Tibia I feminæ duplo, maris circiter duabus partibus longior quam crassior; in mare pars citerior incrassata, margine inferiore et anteriore ultra medium in processum majorem, margine inferiore et posteriore citra medium in processum minorem productis.—Metatarsi I margo inferior in mare plus curvatus quam in femina. Metatarsus III maris supra valde excavatus, marginibus alte extenuatis, quare vix ultra duplo longior quam crassior.—Articuli tarsales III maris infra inspecti: primus aliquanto latior quam longior; secundus parte tertia longior et vix angustior quam primus; tertius paullo angustior quam secundus et paullo brevior quam primus; quartus paullo longior et manifesto angustior quam tertius. Apex marginis posterioris articuli primi non altior quam basis marginis posterioris articuli secundi. Pars citerior marginis posterioris articuli secundi subrecta; lamina cyathiformis ab apice tarsi inspecta apicem anteriem articuli fere attingit, a parte cetera apicis sub angulo pæne recto separata; itaque concavitas laminae basin potius quam marginem anteriorem adspicit.—Processus mobilis articuli primi tarsi III: pars basalis duplo brevior quam pars apicalis, in latere inferiore ad apicem subito incrassata; processus anterior partis apicalis depressus falciformis, processus præcipiuus incisura apicali in partes duas divisus; pars anterior, multo major, in speciem laminae formata, in mucronem apicalem anteriorem angustum et angulum apicalem posteriorem acutum producta; pars posterior est processus haud longus, obliquus, leviter depressus.

Color maris fusco-ruber, feminae fusco-ferrugineus; palpis et tarsis vix dilutioribus. Femina immatura subfusca, palpis et pedibus fusco-fulvis, parte ulteriore dimidia partis tibialis brunnea. Pullus fulvo-testaceus, pedibus fusco-punctatis, parte ulteriore majore partis tibialis brunnea.

Long. corp. ♂ 6·9, ♀ 7·1 mm.; long. cephaloth. ♂ 2·8, ♀ 2·7 mm.; lat. cephaloth. ♂ 2·6, ♀ 2·75 mm.; long. abd. ♂ 4·2, ♀ 4·4 mm.; palpi ♂ 4·3, ♀ 5 mm.; pedes I ♂ 6·2, ♀ 5·9; II ♂ 11·3, ♀ 11·1; III ♂ 7·8, ♀ 7·2; IV ♂ 8·4, ♀ 8·2 mm.

Pullus (4·2 mm. longus, pede I 5·5) a senioribus hisce notis ejusdam momenti differt: Sulci cephalothoracis medius ante evanidus, posterior transversus et marginales desunt. Palporum pars femoralis duplo et parte tertia longior quam crassior, fere lævis; pars tibialis prope basin pæne dimidio crassior quam ultra medium, ad apicem vix incrassata et granulata. Articuli tarsales: I, 4, 3, 2; II primus et secundus inter se æque longi, tertius duplo longior quam secundus, quartus æque longus atque tertius et eodem pæne crassior; III tertius manifesto longior quam primus et secundus simul sumpti; IV secundus dimidio longior quam prior.

Variatio: In mare altero (e museo Berolinensi) processus marginis inferioris et posterioris tibiae I deest. Metatarsus I in mare altero (e museo Holmiensi) infra aliquanto latior quam in femina.

Patria: Africa centralis occidentalis. Exempla sex perlustravimus, in Kamerun collecta: tria in museo Holmiensi asservata, marem et feminam immaturam in loco quodam N'dian in mense Junio et pullum in loco quodam Bibundi in mense Augusto a cl. Dr. Yngve Sjöstedt capta; tria in museo Berolinensi in Joh. Albrechtshöhe a cl. L. Conradt capta, marem et feminam in mensibus Martio et Julio, et feminam (?) immaturam in mense Augusto.

6. *Cryptostemma Karschii* n. sp.

Tab. VIII., figg. 4a—4b; Tab. IX., figg. 1a—1l.

5·6—6·6 mm. longum, nigrum aut fusco-ferrugineum; dorsum corporis granis magnis et granulis densis praeditum; sulcus medius cephalothoracis latior, pone sat profundus; sulcus transversus anterior deest; intra angulum submedium impressio parva perlevis semicircularis solum adest; cucullus sulcis lateralibus destitutus, perpaullo longior quam ad basin latior, ultra medium plus dimidio latior quam ad basin; palporum pars femoralis non duplo longior quam crassior, infra granulata, supra impresso-punctata, pars tibialis prope basin dimidio crassior quam ultra medium, ad apicem versus vix incrassata; pedes granis ex parte maiore magnis minus densis, infra in fenoribus I et II et in tibia I partim subacutis, et pilis duplo, et in metatarsis partim ultra, longioribus quam granis ornati; femora supra non sulcata. In mare tibia I aliquantum incrassata processibus destituta; femur II ad medium plus duplo crassius quam femur I.

1892. *Cryptostemma Westermanni* Karsch, nec Guér. ('Berl. Ent. Zeitschr.', vol. XXXVII., p. 31, Tab. IV.).

Cephalothorax perpaullo longior quam latior, granis magnis et granulis densis fere scaber. Pili granis immixti granis manifesto altiores. Margo lateralis ante angulum submedium vix emarginatus. Sulcus medius cephalothoracem circiter dimidium efficiens, pone sat profundus; transversus anterior deest; transversus posterior levus; marginales manifesti. Mox intra angulum submedium impressio parva adest, levus aut (in mare) perlevis, extra concava.

Cucullus perpaullo longior quam ad basin latior, ultra medium plus dimidio latior quam ad basin; margo anterior vix emarginatus; sulci laterales desunt. Grana manifesto minora et densiora quam in cephalothorace.

Abdomen. Grana dorsi minus densa quam in cephalothorace; grana arearum lateralium minora, cetera majora quam ea cephalothoracis. Impressiones musculares ventrales primae sat profundae, secundae et tertiae leves; dorsuales omnes sat profundae. Grana ventralia densa, multo minora quam dorsalia, posteriora versus majora. Grana mandibularum et coxarum II subaeque magna atque ventralia; grana coxarum III et IV manifesto minora quam grana coxarum II.

Antennarum articuli primi processus major paullo longior quam ad basin latior, dentibus (præter apicalem) quinque armatus. Articulus secundus dentibus triangulis, subacutis novem serratus.

Palporum pars trochanterica prior partim granulata. Pars trochanterica secunda in parte inferiore granulata et in parte dorsuali impresso-punctata. Pars femoralis non duplo longior quam crassior, deorsum aliquantum curvata, in parte inferiore granulata, in parte dorsuali impresso-punctata. Pars tibialis prope basin dimidio et ad apicem vix crassior quam ultra medium, granulata.

Pedes, tarsis exceptis, granis inaequalibus praediti, inter se spatio separatis, quod majus aut minus est quam basis grani; grana plurima vix conica, obtusa, humiliora quam ad basin crassiora; grana magna subacuta: prope margines anteriorem et posteriorem posita. Inferiora femorum I et II et tibiae I et superiora metatarsorum omnium. Pili granis immixti duplo et partim, imprimis in metatarsis, triplo vel quadruplo longiores quam grana. Diametrum basalis (sive interior) coxae II saltem vix minor quam diametrum coxarum III et IV simul sumptuarum. Femora supra non sulcata. Tarsus I paene duplo crassior quam apex metatarsi. Tarsi II articulus quartus duplo et paene dimidio longior quam tertius et dimidio quam quintus.

Differentia sexualis: Cucullus feminæ leviter et subaequaliter convexus; in mare pars basalis circiter dimidia prope latera leviter depressa aut impressa quidem, et pars anterior media subplana aut¹

¹ Hoc in easu cucullus arcu transverso humiliter elevato, partem excavatam limitante, prædictus est, formam cuculli Cryptocelli Simonis in mentem revocans.

leviter excavata quidem. Grana arearum dorsualium lateralia minora in mare quam in femina. Femur II maris plus duplo vel paene triplo, feminæ paene dimidio longius quam I. Tibia I maris præsertim infra incrassata, processu destituta, dimidio et feminae duplo longior quam crassior. Metatarsi maris I infra fere in angulum incrassatus; II prope basin subito sursum leviter curvatus; III duplo longior quam crassior, margo anterior-superior adversus apicem processus mobilis non angulatus.—Articuli tarsales III maris primus paullo latior quam longior; secundus dimidio longior et vix angustior quam primus; tertius manifesto angustior et duplo brevior quam secundus; quartus paullo angustior et non dimidio longior quam tertius. Apex marginis posterioris articuli primi manifesto (quamquam paullo) altior quam basis marginis posterioris articuli secundi. Margo posterior articuli secundi altior ad basin quam paullulo ultra; ab apice tarsi inspectam lauinam cyathiformem, vix ultra medium apicis articuli attingentem, a parte cetera apicis, in angulo anteriore leviter elevata, incisura sat profunda separat; itaque concavitas laminæ marginem anteriorem potius quam basin articuli adspicit. Processus mobilis articuli primi tarsi III: pars apicalis dimidio longior quam pars basalis; processus anterior depresso, subtriangularis, rectus (non falciformis); processus præcipuus in speciem laminæ formatu, in parte ulteriore retro curvatus, et ibi in partes duas pallidas divisus, posteriorem sat angustum et anteriorem latam rotundatam, dentes breves tenues inferiores duos præbentem, apici et margini anteriori propinquos.

Nigrum aut fusco-ferrugineum.

Long. corp. ♂ 5·6, ♀ 6·6 mm.; long. cephaloth. ♂ 2·4, ♀ 2·6 mm.; lat. cephaloth. ♂ 2·2, ♀ 2·4 mm.; long. abd. ♂ 3·25, ♀ 4 mm.; palpi ♂ 3·75, ♀ 4·25 mm.; pedes I ♂ ♀ 6; II ♂ 10·8, ♀ 10·6; III ♂ 7·2, ♀ 7; IV (♂ sine tarso 6·7) ♀ 7·9 mm.

Patria: Africa centralis occidentalis. Exempla quattuor perlustravimus: marem et feminam, ab ill. Dr. Karsch descripta, in museo Berolinensi asservata, in colonia Germanica Kamerun, ad oppidum Kribri, ad flumen Kribri prope Batangam majorem jacens, collecta, et marem et feminam ad flumen Benita in Congo a cl. G. L. Bates capta et in Museo Britannico asservata.

De Synonymia: Ill. Dr. Karsch judicavit hanc speciem eandem esse atque C. Westermannii Guér. Hac autem in re illustrem auctorem sequi non possumus. Hisce notis enim, a Guérin et Gervais commemoratis, C. Westermannii a C. Karschii differt: cephalothorax impressione lateraliter obliqua profunda ("forte") prædictus est, quæ impressio autem in C. Karschii tam levis est, ut ab ill. Karsch neque commemorata neque delineata sit. Et cucullus sulcis lateralibus prædictus est ("rebordé"), qui sulci in C. Karschii desunt. Denique: sulco medio per longitudinem cuculli ducto C. Westermannii a ceteris speciebus adhuc cognitis differt.

2. CRYPTOCELLUS Westw.

1874. *Cryptocellus* Westwood ('Thesaurus Oxoniensis', p. 201).

Antennarum articulus primus processu subapicali unico prædictus, saltem paene duplo longiore quam ad basin latiore. Articulus secundus ad latus interius versus tenuior in aciem sensim extenuatus.

Cephalothoracis margo anterior partem non dimidiatur latitudinis maximæ efficiens.

Coxæ II diametru basalis ad summum non major quam diametru coxæ III.

Coxarum IV margines posteriores inter se angulum fere rectum formantes, quare pars triangula segmenti abdominalis ventralis tertii (magnorum primi) non plus duplo latior quam longior est.

Tarsus I saltem parte tertia longior quam crassior.

Tarsi II articulus quartus æque longus atque quintus.

Tarsorum III et IV apex desuper inspectus profunde incisus.

Metatarsus III maris cavo dorsuali unico instructus, quare processus mobilis metatarsi liber est; cavum dorsuale latum, in alveos duos non divisum, laminam cyathiformem tarsi adducti non amplectens. Processus anterior partis apicalis processus mobilis articuli tarsalis III primi deest.

Species Americae meridionalis indigenæ.

Conspectus specierum.

1. Sulcus transversus anterior cephalothoracis levis, valde curvatus; cucullus ultra medium vix ultra parte quarta latior quam longior 1. *C. fœdus* Westw.
2. Sulcus transversus anterior cephalothoracis deest; cucullus prope apicem $\frac{3}{5}$ latior quam longior 2. *C. Simonis* n. sp.

I. *Cryptocellus fœdus* Westw.

Tab. IX.; figg. 2 a—2 e.

Femina vix 5 mm. longa, supra nigra, infra fusco-ferruginea; dorsum corporis dense et subtiliter granulatum; sulcus medius cephalothoracis haud profundus, pone levis; sulcus transversus anterior levis valde curvatus; intra angulum submedium sulcus brevis profundus, obliquus adest; cucullus paullo longior quam ad basin latior, ultra medium $\frac{2}{5}$ latior quam ad basin, levissime convexus, sulco basali transverso levi præditus; palporum pars femoralis non granulata, duplo et dimidio longior quam crassior; pedes granulis parvis sparsis et præter pilos pube oppressa prædicti; femora supra non sulcata.

1874. *Cryptocellus fœdus* Westwood ('Thes. Oxon.', p. 201, Tab. XXXVII., fig. 5).

Cephalothorax æque latus atque longus, dense et subtiliter granulatus; margo anterior leviter, tamen manifesto emarginatus. Margo lateralis ante angulum submedium sat leviter emarginatus. Sulcus medius angustus, haud profundus, pone levis, partes duas longitudinis cephalothoracis efficiens; sulcus transversus anterior levis, sat longus, valde procurvus; transversus posterior sat manifestus, præsertim in medio; e fine anteriore sulci medii exit sulcus latus (vel impressio levis), parti anteriori marginum lateralium parallelus et cum sulco marginali sat profundo extra confluens; intra angulum submedium sulcus brevis profundus rectus obliquus adest.

Cucullus paullo longior quam ad basin latior, ultra medium $\frac{2}{5}$ latior quam ad basin et vix ultra parte quarta latior quam longior; levissime convexus, sulco transverso subbasali levi præditus, prope margines laterales breviter antrorsum producto, ceterum sulcis destitutus; ante levissime emarginatus. In lateribus lèvis, ceterum minus dense granulatus; ad marginem anteriorem pilis longioribus ornatus.

Abdomen. Dorsum eodem modo quo cephalothorax granulatum. Impressiones musculares dorsuales profundæ. Pars triangula segmenti ventralis tertii (primi magnorum) ad latera subtilissime granulata; pars cetera segmenti tertii et segmentum quartum vix granulata; partes ceteræ et impressiones musculares leves densissime granulatae. Coxæ lèves.

Antennarum articulus primus per duas partes basales longitudinis sensim latior; processus haud duplo longior quam ad basin latior, dentibus rotundate triangulis quattuor armatus, ultimo multo majore quam ceteris. Articulus secundus levissime dilatatus, pene quadruplo longior quam in medio latior, dentibus septem munitus.

Palporum partes trochantericæ parce granulatae. Pars femoralis non granulata, pilis sparsis partim longis ornata, prope apicem deorsum leviter curvata, duplo et dimidio longior quam crassior. Pars tibialis non granulata prope basin dimidio crassior quam ultra medium, ad apicem vix angustior quam prope basin; ad apicem carinula per longitudinem ductæ adsunt.

Pedes præter pubem breuem tenuem oppressam pilis præsertim infra ornatæ; femora, patellæ, tibiae, metatarsi granulis parvis nonnullis sparsis prædicta. DiametruS basalis (sive interior) coxae II non major quam eadem coxae III et vix duplo major quam eadem coxae IV. (Trochanteres III et IV mutici.) Femora supra non sulcata; I pene duplo longius quam crassius, prope apicem aliquantum angustum, margine inferiore arcuato et prope apicem incurvo; II duabus partibus longius nec autem crassius quam I. Tibiae supra convexæ, infra ultra medium late excavatae. Metatarsi aliquantum curvati. Tarsus I $\frac{2}{3}$ longior quam crassior. Tarsi II articulus tertius pene longior quam crassior, quartus dimidio longior quam tertius, quintus leviter compressus non brevior et manifesto crassior quam quartus.

Supra opace nigrum, infra fusco-ferrugineum.

Long. corp. 4·9 mm.; long. et lat. cephaloth. 2 mm.; long. abd. 3 mm.; palpi 3·7 mm.; pedes I 4·6; II 7·7; III 5·2; IV 5·5 mm.

Patria: Brasilia. Specimen unicum, ab ill. Westwood descriptum, feminam, vidimus, in provincia Amazone a cl. Bates (1861) collectam, in Museo Oxoniensi sicciam asservatam.

2. *Cryptocellus Simonis* n. sp.

Tab. IX., figg. 3a—3i.

Mas 5·3 mm. longus, ferrugineus partim infuscatus; dorsum corporis ex parte subtiliter granulatum; sulcus medius cephalothoracis levus, pone subdeletus; sulcus transversus anterior deest; intra angulum submedium sulcus brevior obliquus haud profundus adest; cucullus paullo longior quam ad basin latior, prope apicem $\frac{2}{5}$ latior quam longior et $\frac{2}{3}$ latior quam ad basin, haud procul a carina basali sulco transverso profundo praeditus, ante quem alte convexus et in parte anteriore media perlata et sat profunde excavatus; palporum pars femoralis non granulata pene duplo et dimidio longior quam crassior; pedes ex parte minore subtiliter granulati, pilosi; femora supra non sulcata. Saltem in mare trochanter IV primus in processum retrorsum directum et trochanter III secundus in processum anteriorem producti; femur I processibus inferioribus duobus praeditum; femur III valde incrassatum; tibia I in margine anteriore processu praedita, metatarsus I prope apicem ante dilatatus. Cephalothorax paullo longior quam latior, subtiliter granulatus, ad medium minus dense, ante et pone vix; præterea pili teretes adsunt, ad margines anteriorem et laterales manifesto longiores. Pars anterior brevior deorsum valde curvata. Margo anterior leviter emarginatus. Margo lateralis ante angulum submedium late rotundatum leviter emarginatus. Sulcus medius angustus, sat levus, pone subdeletus, partes tres longitudinis cephalothoracis efficiens; sulcus transversus anterior deest; sulcus transversus posterior levus, in medio subdeletus; e fine anteriore sulci medii exit sulcus latus (vel impressio levis), cum sulco marginali mediocri, longiore, valde curvato extra confluens; intra angulum submedium sulcus brevior, obliquus, haud profundus adest.

Cucullus paullo longior quam ad basin latior, prope apicem $\frac{2}{5}$ latior quam ad basin et $\frac{3}{5}$ latior quam longior. Haud procul a basi carinata sulcus profundus transversus leviter curvatus adest, margines laterales non attingens; ante quem cucullus alte convexus est et deinde (in parte media anteriore) perlata et sat profunde concavus. Sulci sublaterales desunt. Granula minora et minus densa in sulco transverso et parte excavata sat manifesta sunt; in parte reliqua desunt. Pili in parte dimidia anteriore longiores et densiores quam in cephalothorace.

Abdomen. Segmentum dorsuale tertium (primum magnorum) et pars media anterior areæ mediae segmenti quarti laevia et glabra; granula in parte reliqua arearum mediarum paullo minora et partim densiora quam in cephalothorace; pili in areis lateralibus vix conspicuis densiores quam in cephalothorace. Granula ventralia impressionum muscularium densissima, segmentorum anteriorum nulla, segmenti sexti pauciora, humilia. Impressiones musculares omnes manifestæ. Mandibulæ et coxae laeve.

Antennarum articulus primus aequo latus per plus quam dimidiæ longitudinem basalem; processus duplo longior quam ad basin latior, dentibus acutis quinque armatus, tertio et quarto minutis, quinto magno. Articulus secundus valde dilatatus, circiter duplo et dimidio longior quam in medio latior, dentibus acutis octo munitus.

Palporum partes trochantericae granulis perpaucis, solum inferioribus, ornatae. Pars femoralis pene duplo et dimidio longior quam crassior, prope apicem deorsum leviter curvata, laevis. Pars tibialis laevis prope basin non dimidio crassior quam ultra medium, ad apicem vix crassior quam prope medium; ad apicem carinulæ per longitudinem ductæ adsunt. Palpi breviter et minus dense pilosi.

Pedes toti pilis brevibus oppressis sat densis et paucioribus longioribus suberectis vestiti. Diametru basalis (sive interior) coxae II paullo minor quam eadem coxae III et non duplo major quam eadem coxae IV. Femora supra convexa; I supra laeve, infra granulis paucis vix manifestis ornatum; II in parte dimidia citeriore granulis inferioribus paucis praeditum, in ordinem fere dispositis; III in latere anteriore granulatum; IV sublaeve; II, circiter dimidio longius et manifesto minus

crassum quam I; III fere inflatum, omnium crassissimum. Articuli sequentes sublaeves. Tibiae subrectae, supra non sulcatae. Tarsus I parte tertia longior quam crassior. Tarsi II articulus quartus circiter dimidio longior quam tertius; quintus leviter compressus non brevior sed crassior quam quartus.

Differentia sexualis¹: Femina incognita. Pedis III trochanter secundus, patella, tibia aliquantum et femur et metatarsus valde incrassata. Trochanter III secundus in processum apicalem anteriorem subrectum conicum obtusum productus. Trochanter IV primus processu posteriore, retrorsum directo et extrorsum leviter curvato, sat magno, obtuso, prope apicem munitus. Femur I processibus inferioribus duobus robustis instructum, altero basali compresso et altero apici propinquo subtransverso, oblique obtuse acuminato. Tibia I vix duplo longior quam crassior; margo anterior in processum brevem compressum productus, ultra medium positum. Metatarsi I in latere anteriore ultérieure infra dilatatus; III dimidio longior quam crassior, valde inflatus, infra in latere anteriore prope apicem aliquantum excavatus, quare carina subapicalis, antrorum vergens, formata est.—Articuli tarsales III primus dimidio latior quam longior; secundus pene duplo longior quam primus et aliquanto brevior quam tertius et quartus simul sumpti, manifesto angustior quam primus; tertius infra inspectus subtriangulus, sive apice duplo latior quam basi; quartus aliquanto longior et pene angustior quam tertius. Margo posterior articuli primi paullo altior quam longitudo articuli. Margo anterior articuli secundi non extenuatus; posterior in laminam cyathiformem magnam, duabus partibus altiore quam altitudinem articuli, elevatus, in apice antrorum non inclinatum, quare cavum ejus solum antrorum adspicit. Pars basalis processus mobilis articuli primi lata et supra profunde impressa; pars apicalis parte basali pene triplo longior in laminam, laminae cyathiformi subsimilem, dilatata, processibus constitutam, sed mucrone apicali subtili sat longo præditam.

Ferrugineus, partim infuscatus; abdomen brunneo-fuscum; pars convexa segmenti dorsualis abdominalis quarti (magnorum secundi) brunneo-fulva; segmenta ventralia tertium (magnorum primum) totum brunneum, quartum totum fulvo-ferrugineum, pars multo major quinti et pars minor media sexti fulvae, impressionibus muscularibus fuscis. Membra fulvo-ferruginea.

Long. corp. 5·3 mm.; long. cephaloth. 2·2 mm.; lat. cephaloth. 2 mm.; long. abdom. 3·1 mm.; palpi 3·2 mm.; pedes I 5·4; II 9; III 5·8; IV 6·3 mm.

Patria: Brasilia. Specimen unicum, marem, vidimus, in provincia Amazone captum, quod ill. E. Simon nobis benevolentissime dedit.

¹ Quod hæc species C. fœdo affinis est, judicamus processus trochanterum III et IV in mare solo adesse.

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EXPLANATION OF THE PLATES¹.

PLATE I.

FIG. 1. *Stylocellus Beccarii* Thorell.

Adult male and female. Nearly all figures are of the male, only figs. 1*m* and 1*r* of the female.

FIG. 1*a*. Male, from above; $\times 17/3$.—*o*. eye; *p*. ‘conus fœtidus’: process containing the outlet from the odoriferous gland.

FIG. 1*b*. Body, with coxae and trochanters of the walking legs, from below; the left antenna and mandible removed; $\times 17/2$.—*a*. front margin of the collar; *b*. basal joint of the antenna with its two processes; *c*. mandibular palpus; *d*. dorsal scutum; *o*. operculum anale; *t*. sulcus lateralis obliquus; *u*. spiracle; *1*—*9*. first to ninth abdominal sternite; (1)—(7). numbering of the same sternites according to the usual conception; *IX*. ninth abdominal tergite.

FIG. 1*c*. Middle part of the collar of the head, from above; $\times 72$.—*s*. sensory setæ.

FIG. 1*d*. Head, from the left side; $\times 8$.—*c*. collar; *d*. lateral wing of the collar; *e*. furrows; *f*. sulcus posterior cephalothoracis; *g*. groove between cephalothorax and abdomen; *o*. eye; *p*. conus fœtidus.

FIG. 1*e*. Terminal part of conus fœtidus, from the outer side; $\times 228$.—*a*. membranous area on which the aperture is to be found.

FIG. 1*f*. Basal part of left antenna, from the outer side; $\times 12$.—*a*. basal inner prolongation; *b*. processus basalis; *c*. processus inferior exterior; *d*. dorsal ridge; *e*. base of the second joint; *m*¹. lowering muscle of the antenna; *m*². lifting muscle of the antenna.

FIG. 1*g*. Second and third joints of the left antenna, from below; $\times 12$.

FIG. 1*g*¹. Distal portion of the same antenna, from below; $\times 37$.

FIG. 1*h*. Clypeus, *cl.*, and labrum, *l.*, from above; $\times 36$.—*p*. processes from clypeus.

FIG. 1*i*. Clypeus and labrum, from the left side; $\times 31$; lettering as in the preceding figure.

FIG. 1*j*. Left mandible with its palpus, from the outer side; $\times 12$.—*a*. trochanterial part; *b*. femoral part; *c*. patellar part; *d*. tibial part; *e*. tarsal part; *f*. claw; *m*. terminal portion of pars manducatoria, and *p*. pars palpigera of the mandible.

FIG. 1*k*. The two proximal joints of the left first walking leg, from the admedian side; $\times 10$.—*a*. lower margin of coxa; *b*. soft tripartite portion of the maxillary lobe; *c*. trochanter.

FIG. 1*k*¹. Basal part of the coxa shown in fig. 1*k*; $\times 25$.—*b*. soft tripartite portion of the maxillary lobe.

FIG. 1*l*. Middle portion of the anterior half of the body of the male, from below; $\times 19$.—*c*. mandible; *d*. terminal face of its pars manducatoria; *cx*¹.—*cx*⁴. first to fourth coxa; *e*. front end of first coxa; *f*. angle limiting the stomotheca in front; *g*. carina stomotheca; *h*. soft tripartite portion of the maxillary lobe of the first coxa; *lcx*². maxillary lobe of the second pair of coxae; *m*. arculi genitales (first abdominal sternite); *r*. operculum genitale; *st*. sternum; *Q*. front part of the second abdominal sternite.

¹ On the terms used in Cyphophthalmi (Pls. I.—V.) see pp. 77, 78; on the terms used in Ricinulei (Pls. VII.—IX.) see p. 145.

FIG. 1 *m.* Middle anterior portion of the body of the female, from below; $\times 19$.—*m.* arculi genitales; *r.* operculum genitale.

FIG. 1 *n.* Antero-lateral portion of the abdomen, from below; $\times 52$.—*a.* suture between abdomen and fourth coxa; *b.* spiracle.

FIG. 1 *o.* Posterior part of abdomen, from below; $\times 16$.—*d.* dorsal shield; *o.* operculum anale; *7—9.* seventh to ninth sternite; *IX.* ninth tergite.

FIG. 1 *p.* Distal portion of the first left walking leg, from the outer side; $\times 12$.—*l.* distal part of tibia; *m.* metatarsus; *n.* widened part of tarsus clothed with vertical hairs; *s.* sensory setæ.

FIG. 1 *q.* Distal portion of the fourth left walking leg in the male, from the outer side; $\times 12$.—*l.* distal part of tibia; *m.* metatarsus; *n.* tarsus; *s.* basal, and *t.* terminal part of the dorsal eminence.

FIG. 1 *r.* Distal portion of the fourth left walking leg in the female, from the outer side; $\times 12$.

FIG. 1 *s.* Dorsal shield, with a portion of the interior organs, from below; $\times 8$.—*c.* collar; *di.* the two anterior pairs of diverticula of the alimentary canal, broken off; *og.* odoriferous gland; *p.* conus fœtidus.

FIG. 1 *t.* Ventral half of the body, from which the dorsal shield shown in fig. 1 *s* was removed; $\times 8$.—*an.* rectum; *di².* basal part of a diverticulum of second pair; *di³.* and *di⁴.* diverticula of third and fourth pair; *v.* portion of the (male) sexual organs; *t.* one of the excretory tubes; the other organs in the front half of the body are omitted and this area on the figure marked with shading.

FIG. 1 *u.* The major portion of the inner genital organs of the male, taken out of the ventral shield and seen from below in their natural position.—*t.* testis; *v.* vesicula seminalis.

FIG. 1 *v.* The entire male copulatory organ, from above; $\times 21$.—*a.* sheath; *b.* penis; *md.* musc. dilatatores vaginæ; *mr.* musc. retractores.

FIG. 1 *x.* Penis, from above; $\times 40$.—*m.* oblique muscular bundles.

FIG. 1 *y.* Penis, from below; $\times 40$.

FIG. 1 *z.* The distal portion of the genital organs of the male seen in the natural position, from above; $\times 10$.—*b.* penis indicated with dotted lines in its sheath; *l.* the terminal portion of vesicula seminalis; *k.* basal portion of the two elongate blind appendices opening into vesicula seminalis just behind the penis.

FIG. 2. *Stylocellus Thorelli* n. sp.

Adult female.

FIG. 2 *a.* Anterior half of the body, from above; $\times 8$.—*c.* collar; *f.* sulcus posterior cephalothoracis; *g.* groove between cephalothorax and abdomen; *o.* eye; *p.* conus fœtidus.

FIG. 2 *b.* The two distal joints of left antenna, obliquely from the upper and outer side; $\times 14$.

FIG. 2 *c.* Middle portion of the anterior half of the body, from below; $\times 17$; antennæ omitted.

FIG. 2 *d.* Distal part of the first left walking leg, from the outer side; $\times 12$.

PLATE II.

FIG. 1. *Stylocellus Weberii* n. sp.

Adult male.

FIG. 1 *a*. Anterior half of the body, from above; $\times 10$.
 FIG. 1 *b*. The two distal joints of the left antenna, obliquely from the upper and outer side; $\times 18$.
 FIG. 1 *c*. Middle portion of the anterior half of the body, from below; $\times 22$; antennæ omitted.
 FIG. 1 *d*. Distal part of the first left walking leg, from the outer side; $\times 31/2$.
 FIG. 1 *e*. Distal part of the last left walking leg, from the outer side; $\times 31/2$.

FIG. 2. *Stylocellus modestus* n. sp.

Male and female.

FIG. 2 *a*. Anterior half of the body of the male, from above; $\times 11$.
 FIG. 2 *b*. The two distal joints of the left antenna (of the male), obliquely from the upper and outer side; $\times 23$.
 FIG. 2 *c*. Middle portion of the anterior half of the body of the male, from below; $\times 22$.
 FIG. 2 *d*. Middle portion of the anterior half of the body of the female, from below; $\times 22$.
 FIG. 2 *e*. Distal part of the first left walking leg (of the male), from the outer side; $\times 18$.
 FIG. 2 *f*. Distal part of the last left walking leg of the male, from the outer side; $\times 18$.

FIG. 3. *Stylocellus sulcatus* n. sp.

Male, female and young specimen.

FIG. 3 *a*. Anterior half of the body of the male, from above; $\times 14$.
 FIG. 3 *b*. The two distal joints of the left antenna (of the male), obliquely from the upper and outer side; $\times 23$.
 FIG. 3 *c*. Cephalothorax and anterior part of abdomen of the male, from below; $\times 14$; antennæ omitted.
 FIG. 3 *d*. Middle portion of the anterior half of the body of the male, from below; $\times 26$.
 FIG. 3 *e*. Middle portion of the anterior half of the body of the female, from below; $\times 26$.
 FIG. 3 *f*. Distal part of the first left walking leg (of the male), from the outer side; $\times 21$.
 FIG. 3 *g*. Distal part of the fourth left walking leg of the male, from the outer side; $\times 21$.
 FIG. 3 *h*. Body of an immature specimen, from below; $\times 27/2$; antennæ and mandibles omitted.—
m. arculi genitales; *2—3.* second and third abdominal sternite; *2l.* lateral separate part—with
 the spiracle—of the second sternite.

FIG. 4. *Stylocellus sumatrana* Westwood.

Adult male.

FIG. 4 a. Body (misshapen), from above; $\times 13/2$.FIG. 4 b. The two distal joints of the right antenna, obliquely from the upper and outer side; $\times 16$.FIG. 4 c. Distal part of the first left walking leg, from the outer side; $\times 19/2$.FIG. 5. *Stylocellus Pocockii* n. sp.

Adult female.

FIG. 5 a. Anterior half of the body, from above; $\times 25/3$.

FIG. 5 b. The two distal joints of the left antenna (of the male), obliquely from the upper and outer side.

FIG. 5 c. Middle portion of the anterior half of the body, from below; $\times 17$.—*d.* terminal soft part of the mandible.FIG. 5 d. Distal part of the first left walking leg, from the outer side; $\times 14$.FIG. 6. *Ogovia grossa* n. gen., n. sp.

Adult female.

FIG. 6 a. The body, from below; scarcely $\times 13$; the basal joint of the antennæ, the proximal part of the mandibular palpus, and the trochanteres of the walking legs are included.—*2, 3, 7.* second, third, seventh abdominal sternites.FIG. 6 b. Mandibular palpus, from the outer side; $\times 24$.—*b.* femoral part.

PLATE III.

FIG. 1. *Ogovia grossa* n. gen., n. sp. (continued).

Adult female.

FIG. 1 a. The animal, from above; $\times 9$. (On each abdominal segment the granules in the anterior transverse row ought to have been rendered smaller than those in the posterior row, which are correct.)FIG. 1 b. The two distal joints of the left antenna, obliquely from the upper and outer side; $\times 24$.FIG. 1 c. Distal portion of the same antenna; $\times 73$.FIG. 1 d. Middle portion of the anterior half of the body, from below; $\times 26$.—*d.* terminal soft part of pars manducatoria of the mandibles; *f.* angle limiting the stomotheca in front; *h.* soft portion of the maxillary lobe of the first pair of coxae.FIG. 1 e. Posterior part of the abdomen, from below; $\times 24$.—*o.* operculum anale; *7.* seventh sternite; *8.* eighth sternite, fused with the ninth sternite and with *IX*, the ninth tergite.FIG. 1 f. Distal part of the first left walking leg, from the outer side; $\times 24$.FIG. 1 g. Distal part of the fourth left walking leg, from the outer side; $\times 24$.

*Explanation of Plate III*FIG. 2. *Pettalus cimiciformis* Cambridge.

Adult male.

FIG. 2 a. The animal, from above; $\times 35/4$.

FIG. 2 b. Body, from below; scarcely $\times 13$.

FIG. 2 c. The two distal joints of the left antenna, obliquely from the upper and outer side; $\times 24$.

FIG. 2 d. Distal portion of the same antenna; $\times 68$.

FIG. 2 e. Left mandibular palpus from the outer side; $\times 24$.

FIG. 2 f. Middle portion of the anterior half of the body, mandibles and labrum¹ included, from below; $\times 28$.

FIG. 2 g. Posterior part of abdomen, from below; $\times 23$.—o. operculum anale; 8. and 9. eighth and ninth sternite; IX. ninth tergite.

FIG. 2 h. Distal part of the first left walking leg, from the outer side; $\times 24$.

FIG. 2 i. Distal part of the last left walking leg, seen obliquely from the outer and upper side; $\times 24$.

FIG. 3. *Pettalus brevicauda* Pocock.

Males, adult and immature.

FIG. 3 a. Body of the adult male, from above; $\times 22/3$.

FIG. 3 b. The two distal joints of the left antenna of the adult male, obliquely from the upper and outer side; $\times 19$.

FIG. 3 c. Middle portion of the anterior half of the body of the adult male, from below; $\times 18$.—a. major part of the basal joint of the antennæ—with the processes; b. labrum; d. terminal soft part of pars manducatoria of the mandible; e. angle limiting the stomotheca in front; g. carina stomothecæ; lcx². maxillary lobe of the second pair of coxae; m. arculi genitales; st. sternum; u. spiracle.

FIG. 3 d. Distal part of the first left walking leg of the adult male, from the outer side; $\times 19$.

FIG. 3 e. Distal part of the last left walking leg of the adult male, from the outer side; $\times 19$.

FIG. 3 f. Proximal part of the tarsus—with the end of metatarsus—shown in the preceding figure, seen obliquely from the outer and upper side.

FIG. 3 g. Body of an immature male specimen, from above; $\times 21/2$.—p. conus foetidus; s¹. sensory seta; I. first abdominal tergite; VI. sixth tergite

FIG. 4. *Purcellia illustrans* n. gen., n. sp.

Male, female and immature male.

FIG. 4 a. Front part of the head of a female, from above; $\times 70$.—s. sensory setæ.

FIG. 4 b. Apical portion of left conus foetidus (of a male), nearly from above; $\times 142$.—op. opening for the odoriferous gland, situated between two small oblong lamellar plates.

¹ The labrum, which is easily seen between the dark-shaded part of the mandibles on fig. 2 f and fig. 3 c, is not shown on most other figures on Pls. 1.—v. representing the mouth; in

these cases it was impossible to discern the labrum, which as a rule is placed deeply in the dark between the mandibles.

FIG. 4c. Ventral skin of an immature male, treated with caustic potash, somewhat pressed down, from below; the apical part of abdomen omitted; $\times 18$.—*m.* = 1. arculi genitales, = the first abdominal sternite; 2*l*. lateral separate portion of the second sternite; 9. ninth sternite.

PLATE IV.

FIG. 1. *Purcellia illustrans* n. gen., n. sp. (continued).

Male and female.

FIG. 1a. Female, from above; $\times 11\frac{1}{2}$.FIG. 1b. Body of the male, from below; $\times 18$.—1, 4, 8, 9. the respective abdominal sternites; *o.* operculum anale; IX. ninth tergite.FIG. 1c. Left antenna (of the male), from the outer side; $\times 26$.FIG. 1d. The two distal joints of the left antenna (of the male), obliquely from the lower and inner side; $\times 26$.FIG. 1e. Distal portion of the same antenna; $\times 70$.FIG. 1f. Left mandible, with its palpus (of a male), from the outer side; $\times 26$.FIG. 1g. Distal portion of pars manducatoria of the mandible shown in the preceding figure; $\times 104$.FIG. 1h. Middle portion of the anterior half of the body of an adult male, from below; $\times 32$.—*m.* arculi genitales.FIG. 1i. Posterior part of the abdomen of an adult male, from below; $\times 25$.FIG. 1j. Middle portion of the anterior half of the body of an adult female, from below; $\times 32$.—*d.* terminal part of pars manducatoria of the mandibles; *f.* angle limiting stomotheca in front; *m.* arculi genitales; *r.* operculum genitale.FIG. 1k. Posterior part of the abdomen of an adult female, from below; $\times 19$.FIG. 1l. Distal part of the first left walking leg (of an adult male), from the outer side; $\times 26$.—*s.* sensory setæ.FIG. 1m. Last left walking leg, coxa omitted, of an adult male, from the outer side; $\times 26$.—*m.* metatarsus.FIG. 1n. Last left walking leg, coxa omitted, of an adult female, from the outer side; $\times 26$.FIG. 1o. Penis, without its sheath, from above; $\times 107$.—*m.* muscles; *o.* place for the orifice of the seminal duct.FIG. 1p. Penis, from below; $\times 107$.—*m.* muscles.FIG. 1q. Penis, from the right side; $\times 107$.

FIG. 1r. The ventral skeleton together with the major part of the genital organs of an adult female; from above; $\times 13$; the skeleton of cephalothorax was completely cleaned, so that the anterior and posterior walls of the coxae are seen as septa—the two anterior pairs of coxae being movable, the septa in question are double.—*a.* sheath of ovipositor with its two pairs of muscles: *md.* musculi dilatatores, and *mr.* musculi retractores; *u.* uterus, from the posterior end of which the oviduct proceeds to the posterior end of ovipositor; *w.* chitinous wall forming a roof above the sexual orifice and the arculi.

FIG. 1s. Sheath of ovipositor with the muscles, from above; $\times 25$.—*l.* oviduct.

FIG. 1 *t.* Ovipositor in its sheath of another specimen, from below; $\times 21$.—*a.* sheath; *b.* ovipositor, indicated with dotted lines; *g.* gland to the sheath; *md.* musculi dilatatores of the sheath; *mr.* musculi retractores; *ms.* muscular stratum on the sheath.

FIG. 1 *u.* Ovipositor, from above; $\times 29$.

FIG. 1 *v.* Distal part of ovipositor, from above; $\times 72$.—*f.* forceps; *n.* nerve; *p.* branched process: a kind of tactile organ.

FIG. 2. *Siro rubens* Latreille.

Adult male.

FIG. 2 *a.* Body, from above, $\times 19$.

FIG. 2 *b.* Middle portion of the anterior half of the body, from below; $\times 53$.—*c.* mandible; *d.* terminal face of its pars manducatoria; *f.* angle limiting the stomotheca in front; *lcx².* maxillary lobe of the second pair of coxae; *m.* arculi genitales.

FIG. 2 *c.* Distal part of the first left walking leg, from the outer side; $\times 40$.

FIG. 2 *d.* Distal part of the last left walking leg, from the outer side; $\times 40$.

FIG. 2 *d¹.* Process on the upper side of the tarsus shown in the preceding figure and more highly magnified.

FIG. 3. *Siro duricorius* Joseph.

Male and female.

FIG. 3 *a.* Front margin of the cephalothorax of the female, from above; $\times 123$.—*s.* sensory setæ.

FIG. 3 *b.* Terminal face of one of the coni fœtidi, showing the thin-skinned area with the fissure which is the opening from the odoriferous gland; $\times 215$.

PLATE V.

FIG. 1. *Siro duricorius* Joseph (continued).

Male and female.

FIG. 1 *a.* Male, from above; $\times 17$.

FIG. 1 *b.* Body of the male, with the basal joint of the antennæ, the mandibles and the trochanteres, from below; $\times 21$.

FIG. 1 *c.* Left antenna (of the male), from the outer side; $\times 32$.

FIG. 1 *d.* The two distal joints of the antenna shown in the preceding figure, obliquely from the lower and inner side; $\times 32$.

FIG. 1 *e.* Distal portion of the same antenna; $\times 100$.

FIG. 1 *f.* Left mandible with its palpus (of the male), from the outer side; $\times 32$.

FIG. 1 *g.* Middle portion of the anterior half of the body of the male, from below; $\times 47$.—*c.* mandible; *d.* terminal portion of pars manducatoria of the mandible; *f.* angle limiting the

stomotheca in front; *g.* carina stomothecæ; *h.* the posterior part of the soft portion of the maxillary lobes of the first pair of coxae; *lcx².* maxillary lobe of the second pair of coxae; *m. arculi genitales.*—The labrum is not shown on this or the following figure.

FIG. 1*h.* Middle portion of the anterior half of the body of the female, from below; $\times 44$.

FIG. 1*i.* Posterior part of abdomen of the male, from below; $\times 28$.—*7—9.* seventh to ninth sternite; *IX.* ninth tergite.

FIG. 1*k.* Distal part of first left walking leg (of the male), from the outer side; $\times 32$.

FIG. 1*l.* Last left walking leg, coxa and trochanter omitted, of the male, from the outer side; $\times 32$.

FIG. 1*m.* Penis, from above; $\times 126$.—*a.* basal part of the sheath, its major part being removed; *b.* penis; *mr.* musculi retractores.

FIG. 1*n.* Penis, from below; $\times 126$.

FIG. 1*o.* Distal part of ovipositor, from above; $\times 80$.—*f.* forceps; *p.* branched tactile process.

FIG. 2. *Parasiro corsicus* Simon.

Male and female.

FIG. 2*a.* Body of the male, from above; $\times 43/2$.

FIG. 2*b.* Left antenna (of the male), from the outer side; $\times 45$.

FIG. 2*c.* The two distal joints of the antenna shown in fig. 2*b.*, obliquely from the upper and outer side; $\times 45$.

FIG. 2*d.* Distal portion of the same antenna; $\times 116$.—*p.* process at the articulation.

FIG. 2*e.* Middle portion of the anterior half of the body of the male, from below; $\times 57$.—*m. arculi genitales.*

FIG. 2*f.* Middle portion of the anterior half of the body of the female, from below; $\times 57$.—*c.* mandible; *d.* terminal portion of pars manducatoria of the mandible; *f.* angle limiting stomotheca in front; *h.* the posterior part of the soft portion of the maxillary lobes of the first pair of coxae; *lcx².* maxillary lobe of the second pair of coxae; *m. arculi genitales.*—The labrum is not shown.

FIG. 2*g.* Posterior part of the abdomen of the male, from below; $\times 40$.

FIG. 2*h.* Distal part of the first left walking leg (of the male), from the outer side; $\times 45$.—*m.* metatarsus divided into two portions by an oblique impression; *s.* sensory setæ.

FIG. 2*i.* Last left walking leg—coxa omitted—of a male, from the outer side; $\times 45$.

FIG. 2*k.* Claw of the second left walking leg (of a male), from the anterior side; $\times 160$.

FIG. 2*l.* Claw of the third left walking leg (of a male), from the anterior side; $\times 160$.

FIG. 2*m.* Tarsus of the last left walking leg of the male, showing the gland, *g.*, in optical section, and the serrate claw; $\times 78$.

FIG. 2*n.* Dorsal portion of the tarsus shown in the preceding figure; $\times 196$.—*d.* duct with the two first ramifications from the gland shown in fig. 2*m.*; *o.* opening of that duct on the ‘eminentia dorsualis’; *s.* small seta. The greyish shading indicates the thickness of the chitine.

FIG. 2*o.* Anterior portions of the genital organs of the male, from below; $\times 55$.—*a.* basal part of the sheath of penis, the remainder of it being omitted; *b.* penis; *l.* distal part of vesicula

seminalis; *k.* and *k'*, the two elongate blind appendices opening into vesicula seminalis just behind the base of penis; of the left appendix, marked *k*, only the anterior part is shown.

FIG. 2 *p.* Ovipositor, from above; $\times 69$.

FIG. 2 *q.* Forceps of ovipositor, from below; $\times 131$; only the basal part of the distal setæ was drawn.

PLATE VI.

In figs. 1—13, representing female sexual organs in Palpatores and Laniatores, the following lettering is used.

a. sheath of ovipositor; *b.* ovipositor; *dg.* ducts from glands accessory to receptaculum seminis; *e.* distal end of ovipositor; *f.* forceps of ovipositor; *l.* oviduct; *o.* operculum genitale; *p.* wart-like prominence, being a tactile organ; *rs.* receptaculum seminis; *rs'*. additional receptacula; *rsc.* contents of receptacula seminis; *rsd.* duct from receptaculum seminis; *w.* interior wall of ovipositor; *md.* muscular dilatator of the sheath; *me.* front muscle to sheath; *mo.* muscle to operculum genitale; *mr.* musculi retractores ovipositoris; *ms.* muscular stratum of the sheath; *mt.* transverse muscular layer beneath the skin of ovipositor.

FIG. 1. Sheath of ovipositor in *Acantholophus tridens* C. Koch, from below; $\times 22$; ovipositor, which is discernible through the sheath, is indicated with dotted lines.

FIG. 2. Left receptaculum seminis and the basal part of the ducts from the accessory glands of *Gagrella minuta* Thor., from above; $\times 184$.

FIG. 3. Ovipositor without its sheath of *Ischyropsalis luteipes* E. S., from above; $\times 22$.

FIG. 4. Receptaculum seminis of *Ischyropsalis luteipes* E. S., from the side; $\times 80$.

FIG. 5. Ovipositor without its sheath of *Nemastoma lugubre* O. F. Müller, from below; $\times 41$.

FIG. 6. Receptaculum seminis of *Nemastoma lugubre* O. F. Müller, from the side; $\times 213$; bundles of spermatozoa are seen through the wall.

FIG. 7. Setæ from the distal part of corpus ovipositoris in *Trogulus rostratus* Latr.; $\times 133$.

FIG. 8. Sheath of ovipositor and operculum genitale of *Discocyrtus testudineus* Holmb., from above; $\times 32$; ovipositor, discernible through the skin of the sheath, is indicated with dotted lines.

FIG. 9. Ovipositor, without its sheath, of *Maracandus (Assamia) reticulatus* E. S.; $\times 24$.

FIG. 10. Terminal part of ovipositor of *Acumontia echinata* Poc., from above; $\times 44$.

FIG. 11. Ovipositor of *Pachylodes uncinatus* W. S., from above; $\times 78$; the outer skin of ovipositor removed excepting on the distal end: also the muscular layer around the proximal half of ovipositor and the essentially longitudinal muscles between the receptacula completely removed.

FIG. 12. Proximal part of ovipositor—with the distal portion of the oviduct—of *Trienonyx Valdiviensis* W. S., from above; $\times 47$; the outer skin of the ovipositor removed; the contents of the receptacula are shining through the transverse muscular layer as darker bodies, while the thick whitish walls of the receptacula are confluent with the surrounding parts on the figure.

FIG. 13. Two double receptacula with their ducts from the dorsal side of ovipositor of *Acumontia echinata* Poc., from above; $\times 73$.

In figs. 14—37, representing male sexual organs in Palpatores and Laniatores, the following lettering is used.

a. sheath of penis; *b.* corpus penis; *c.* glans penis; *cb.* limit between corpus and glans penis; *d.* distal tube of glans; *d'.* proximal portion of the dorsal part of glans—in Laniatores—terminating in the distal tube; *e.* ventral part of glans in Laniatores; *g.* one of the lubricating glands of the sheath; *o.* operculum genitale; *vs.* pars ejaculatoria of vesicula seminalis; *w.* thin-skinned, window-like area on glans in *Ischyropsalis*; *mc.* muscle or muscles within corpus penis to glans; *me.* muscle to the front part of the sheath in Palpatores; *mf.* muscle on the posterior part of the sheath in *Ischyropsalis*; *mg.* muscle on the posterior part of the sheath in *Nemastoma*; *mh.* musculi dilatatores of the sheath in *Nemastoma*; *mo.* muscle to operculum genitale in Laniatores; *mp.* musculi protractores; *mq.* crossing muscular strata on the sheath in Laniatores; *mr.* musculi retractores penis; *tmc.* tendons of the muscles (or muscle) *mc.* to glans.

FIG. 14. Penis, without sheath, of *Platybunus corniger* Herm., from above; $\times 22$.

FIG. 15. Glans and distal part of corpus penis of the organ shown in fig. 14, from the right; $\times 45$.

FIG. 16. Penis, without sheath, of *Sclerosoma quadridentatum* Cuv., from above; $\times 38$.

FIG. 17. Glans and distal part of corpus penis of the organ shown in fig. 16, from the right; $\times 91$.

FIG. 18. Sheath and penis of *Ischyropsalis dispar* E. S.; $\times 16$; the sheath is seen from above, its distal part and musculi protractores and retractores omitted; the penis is turned somewhat to the left.

FIG. 19. Glans and distal part of corpus penis of the organ shown in fig. 18, from the right; $\times 52$.

FIG. 20. Penis, without sheath, of *Nemastoma lugubre* O. F. Müll., seen obliquely from above and from the left side; $\times 41$.

FIG. 21. Glans and distal part of corpus penis of the organ shown in fig. 20, and in the same position; $\times 184$.

FIG. 22. Sheath with penis of *Nemastoma argenteo-lunulatum* E. S., from above; $\times 43$; of the muscles *mp.* on the right half and *mg.* on the left half are omitted.

FIG. 23. Proximal part of the sheath with penis of the organ shown in fig. 22, from below; $\times 70$; of the muscles only *mg.* are drawn.

FIG. 24. Proximal part of the same penis without sheath, from above, showing the two internal muscles; $\times 72$.

FIG. 25. Glans and distal part of penis of the organ shown in fig. 22, from above; $\times 210$; the transverse stripes on corpus penis are shown.

FIG. 26. Penis, without sheath, of *Troglulus sinuosus* W. S.; from below and with the apex turned by pressure somewhat to the left; $\times 40$.

FIG. 27. Glans and distal part of corpus penis of the organ shown in fig. 26 and in the same position; $\times 120$.

FIG. 28. Sheath with muscles, lubricating gland, operculum and penis of *Discocyrtus testudineus* Holmb., from the left side; $\times 22$; of *mp.* a greater part is removed in order to show the crossing muscular layers *mq.*; of *mr.* only a part is shown.

FIG. 29. Penis, without sheath, of the organ shown in fig. 28, from above; $\times 22$.

FIG. 30. Glans and distal part of corpus penis of the organ shown in fig. 29, from above; $\times 76$.

FIG. 31. Glans and distal part of corpus penis of the same animal, from the right side; $\times 76$.

FIG. 32. Penis, without sheath, of *Maracandus reticulatus* E. S., from below; $\times 24$.

FIG. 33. Glans and distal part of corpus penis of the organ shown in fig. 32, from above; $\times 66$; the seminal duct is indicated with dotted lines through the whole length of glans.

FIG. 34. The same glans and distal part of penis, from the right side; $\times 66$.

FIG. 35. Sheath with its muscles, penis and pars ejaculatoria of vesicula seminalis of *Acumontia rostrata* Poc., from the right side; $\times 20$; of musculi retractores, *mr.*, only about one third of the total length is shown.

FIG. 36. Penis, without sheath, of the organ shown in fig. 35, from above; $\times 33$.

FIG. 37. Glans and distal part of corpus penis of the same animal, from the right side; $\times 42$; the portion marked *e* looks like a process, but it is the lateral view of the plate which in fig. 36 is marked with the same letter.

PLATE VII.

FIG. 1. *Cryptostemma crassipalpe* n. sp.

Immature specimen.

FIG. 1 *a*. The animal, from above; $\times 7$.—*c*. cucullus; *p*. palp; *t*. 'tail,' consisting of seventh, eighth and ninth abdominal segments.

FIG. 1 *b*. The animal, from below; the distal part of the walking legs omitted; scarcely $\times 9$.—*a*. antenna; *c*. cucullus; *f*. femur of the fourth pair of walking legs; *p*. mandibular palp; *tr*¹. first trochanter, and *tr*². second trochanter of the fourth leg; *v*³. third abdominal sternite.

FIG. 1 *c*. Cephalothorax, from below; cucullus, antennæ, mandibles and coxae of the fourth pair of walking legs removed; $\times 16$.—*c*¹. coxa of the first pair of walking legs; *c*³. coxa of the third pair; *l*. long setæ, *in situ* hidden in the ventral median groove of the fused mandibles; *st*. sternum; *tr*. trochanter of the first pair of walking legs.

FIG. 1 *d*. Cucullus, from above (from in front); $\times 24$.

FIG. 1 *e*. Cucullus, from below; $\times 24$.—*r*. ridge in the middle line.

FIG. 1 *f*. Left antenna, from above; $\times 36$.—*a*. connective membrane folded round the basal portion of the first joint; *p*¹. upper, and *p*². lower distal process from the first joint; *2*. second joint.

FIG. 1 *g*. Same antenna, from the inner side; $\times 36$; the lettering as in fig. 1 *f*.

FIG. 1 *h*. Distal part of the same antenna, from below; $\times 36$.

FIG. 1 *i*. Hair from the lower side of the antenna; $\times 170$.

FIG. 1 *k*. Mandibles, from below; $\times 28$.—*a*. anterior free margin; *b*. posterior margin of the lower wall; *c*. crest originating from the upper wall of the mandibles and from pars basalis labri; *d*. œsophagus, perforating the crest named; *m*¹. and *m*². muscles to the first trochanterial part of the mandibular palp; *m*³. pumping muscle; *m*⁶. muscle raising the anterior end of the mandibles; *m*⁷. muscle lowering the anterior end of the mandibles; *tr*. first trochanterial part of the palpus.

FIG. 1 *l*. The mandibles, from below, as in the preceding figure; but the muscles *m*¹, *m*² and *m*³ removed in order to show the shape of the proximal half of the dermoskeleton. The major part of the long tendons of *m*⁶ and *m*⁷ (comp. fig. 1 *k*) drawn, but the trochanter omitted.—*f*. proximal portion of pars basalis of the labrum.

FIG. 1 *m.* Mandibles with labrum, from above; $\times 28$.—*a.* anterior free margin of the fused mandibles; *e.* pars apicalis of the labrum; *f.* pars basalis of the labrum; *g.* posterior portion of the left mandible; *l.* transverse line, being the front border of the membranous skin which lies close on the dorsal surface of the posterior part of the mandibles and of the pars basalis of the labrum; at the front border named this membranous skin turns upwards towards the base of the antennæ; *m⁶.* tendon of the muscle raising the anterior end of the mandibles.

FIG. 1 *n.* Mandibles with labrum, as in the preceding figure, from above; the musculature and the basal part of the first trochanterial part of the palpus are seen by transmitted light.—*m¹.* and *m².* muscles to the first trochanterial part; *tr.* of the mandibular palpus; *m⁴.* muscle to the pars apicalis of the labrum; *m⁵.* muscle of doubtful function; *m⁶.* tendon of the muscle raising the anterior end of the mandibles.

FIG. 1 *o.* Left mandibular palp, from in front; $\times 24$.—*a.* first trochanterial part; *b.* second trochanterial part; *c.* femoral part; *d.* tibial part; *e.* tarsal part.

FIG. 1 *p.* Distal part of the first right leg, obliquely from in front and from above; $\times 24$.—*a.* distal part of the femur; *b.* patella; *c.* tibia; *d.* metatarsus; *e.* tarsus; *f.* claws.

FIG. 1 *q.* The 'tail,' consisting of the seventh, eighth and ninth abdominal segments, from above; $\times 37$. The proximal segment, 7., turns slightly upwards, the two distal segments, 8. and 9., turn considerably upwards; *a.* anus.

FIG. 1 *r.* Hair from the anterior side of the femur of the second pair of legs; $\times 305$.

FIG. 1 *s.* Another hair from the same place; $\times 305$.

FIG. 1 *t.* Portion of the lower margin of the femur of the second pair of legs, showing two of the grooved grains and two kinds of hairs; $\times 200$.

FIG. 1 *u.* Portion of the skin from the distal part of the upper and outer margin of the tibia of the fourth pair of legs, showing four grooved grains, one of the large scaly hairs and the exceedingly dense short pubescence; $\times 300$.

FIG. 1 *v.* Upper terminal portion of the last tarsal joint of the fourth pair of legs, from above; $\times 300$.—*h.* spatulate hair; *s.* sensory hair.

FIG. 1 *x.* The right tracheal trunk with the basal portion of the tracheal tubes, somewhat diagrammatic, seen from above and somewhat obliquely from the inner side; $\times 122$.—*o.* outer margin of the trunk.

FIG. 1 *y.* Small portion of the inferior margin of the right spiracle, from the inner side; $\times 364$.

FIG. 2. *Cryptostemma plebeium* n. sp.

Immature female.

FIG. 2 *a.* The animal, from above; scarcely $\times 5$.

FIG. 2 *b.* Cucullus, from above (from in front); $\times 12$.

FIG. 2 *c.* Left mandibular palp, from in front; $\times 13$.

FIG. 2 *d.* Distal part of the first right leg, obliquely from in front and from above; $\times 12$.

FIG. 2 *e.* Scaly hair from the anterior side of the femur of the second pair of legs, from above; $\times 300$.

FIG. 2 *f.* The same hair, from the side.

FIG. 3. *Cryptostemma Westermannii* Guérin.

Adult male.

FIG. 3 a. Cueullus, from above; $\times \frac{19}{2}$.—*l.* ‘suleus lateralis.’FIG. 3 b. Left mandibular palpus, from in front; $\times 11$.

PLATE VIII.

FIG. 1. *Cryptostemma Westermannii* Guérin (continued).

Adult male.

FIG. 1 a. Cephalothorax (cucullus omitted) and basal part of abdomen, from above; $\times 7$.FIG. 1 b. Distal part of the first right leg, obliquely from in front and from above; $\times 9$.FIG. 1 c. Second right leg, obliquely from in front and from above; $\times 5$.FIG. 1 d. Portion of the skin from the upper side of the femur of the second pair of legs, showing six large grains, numerous scaly hairs and a few thin hairs; $\times 56$.FIG. 1 e. The movable process (‘processus mobilis’) of the copulatory organ of the third left leg, seen from in front; $\times 23$.FIG. 1 f. Distal half of the movable process shown in the preceding figure, seen from below; $\times 33$.FIG. 2. *Cryptostemma Afzelii* Thorell.

Adult female.

FIG. 2 a. Cephalothorax (and the basal portion of the abdomen), from above; $\times 9/2$.FIG. 2 b. Cucullus, from above; scarcely $\times 8$.FIG. 2 c. Portion of the skin from the distal half of the cucullus; $\times 25$.FIG. 2 d. Right antenna, from in front; scarcely $\times 11$.FIG. 2 e. Left mandibular palp, from in front; scarcely $\times 9$.FIG. 2 f. Distal part of the first right leg, obliquely from in front and from above; $\times 8$.FIG. 2 g. Ventral view of the proximal portion of the fourth pair of walking legs and of the basal portion of the abdomen in a specimen with the abdomen bent unusually upwards; $\times 17/2$.—*c*⁴. fourth coxa, with the first trochanter, *d.*; *k.* keel on the posterior border of the fourth coxa; *m.* soft connective membrane; *o.* genital opening; *v*¹. first abdominal sternite; *v*². second sternite; *v*³. third sternite; *v*⁴. anterior part of fourth sternite.FIG. 3. *Cryptostemma Sjöstedtii* n. sp.

Adult male, immature female and a young one.

FIG. 3 a. Adult male, from above; scarcely $\times 5$.FIG. 3 b. Immature female, from above; scarcely $\times 5$.FIG. 3 c. Cucullus of the adult male, from above; $\times 12$.

FIG. 3 d. Left mandibular palp of the adult male, from in front; $\times 14$.

FIG. 3 e. Left mandibular palp of a young one; $\times 22$.

FIG. 3 f. Distal part of the first right leg of the adult male, obliquely from in front and from above; scarcely $\times 11$.

FIG. 3 g. Distal part of the first right leg of the immature female, obliquely from in front and from above; $\times 14$.

FIG. 3 h. Distal part of the third left leg of the adult male, from in front; $\times 17$.—*a.* terminal portion of the tibia; *b.* metatarsus; *c.* its movable process; *d.* first tarsal joint; *d'*. second 'joint' of its movable process; *e.* second tarsal joint; *e'*. front margin of the distal lower wall of its 'lamina cyathiformis'; *e''*. posterior high wall of the 'lamina cyathiformis.'

FIG. 3 i. Second portion of the tarsal movable process of the organ shown in fig. 3 h, seen essentially from above; $\times 31$.

FIG. 3 k. The same part as shown in fig. 3 i, seen essentially from below; $\times 31$.

FIG. 3 l. Distal portion of the metatarsus with the four-jointed tarsus of the second right leg of a young one; $\times 17$.

FIG. 3 m. Terminal portion of the tibia with the metatarsus and the two-jointed tarsus of the fourth right leg of a young one; $\times 17$.

FIG. 4. *Cryptostemma Karschii* n. sp.

Adult male.

FIG. 4 a. Cephalothorax with the legs mutilated and without cucullus, from above; scarcely $\times 5$.

FIG. 4 b. Mandibles (taken out) with their palps, from below; $\times 11$.

PLATE IX.

FIG. 1. *Cryptostemma Karschii* n. sp. (continued).

Adult male and adult female.

FIG. 1 a. Adult female, from above; scarcely $\times 5$.

FIG. 1 b. Cucullus of the adult male, from above; $\times 13$.

FIG. 1 c. Left antenna of the adult male, from above; $\times 26$.

FIG. 1 d. Distal part of the first right leg of the adult male, obliquely from in front and from above; $\times 12$.

FIG. 1 e. Distal part of the first right leg of the adult female, from above; $\times 12$.

FIG. 1 f. Dorsal view of the anterior part of the abdomen of the adult male; $\times 10$.—*d'*—*d''*. first to fourth abdominal tergite; *i.* muscular impression; *k.* keel (compare the text, p. 122); *m.* connective membrane on the side of the stalk of the abdomen outside the first tergite; *v*³. front end of the third sternite.

FIG. 1 g. Ventral view of the anterior part of the abdomen shown in the preceding figure; $\times 10$.—*k.* keel; *v*³.—*v*⁴. third and fourth sternite. The first and second sternites are wanting (comp. fig. 2 g on Pl. VIII.).

FIG. 1*h*. Distal part of the third left leg of the adult male, from in front; $\times 14$. Hairs, the movable process of the first tarsal joint and the major part of the terminal (fourth) tarsal joint omitted.—*a*. Distal portion of the tibia; *b*. metatarsus; *c*. its movable process; *d*. first tarsal joint; *d'*. high crest from the posterior wall of the first tarsal joint; *e*. second tarsal joint; *e'*. front margin of the distal lower wall of the ‘lamina cyathiformis’; *e''*. posterior high wall of the ‘lamina cyathiformis’; *f*. third tarsal joint.

FIG. 1*i*. Movable process from the first tarsal joint of the organ shown in fig. 1*h*, from in front and drawn with the same degree of enlargement, viz. $\times 14$.

FIG. 1*k*. The movable process shown in fig. 1*i*, more highly magnified.

FIG. 1*l*. The movable process from the first tarsal joint of the organ shown in fig. 1*h*, from above; $\times 29$.

FIG. 2. *Cryptocellus fædus* Westwood.

Adult female.

FIG. 2*a*. The animal, from above; scarcely $\times 6$.

FIG. 2*b*. Cucullus, from above; $\times 17$.

FIG. 2*c*. Left antenna, from above (or from in front); $\times 36$.

FIG. 2*d*. Left mandibular palp, from in front; $\times 17$.

FIG. 2*e*. Distal part of the first right leg, obliquely from above and from in front; $\times 15$.

FIG. 3. *Cryptocellus Simonis* n. sp.

Adult male.

FIG. 3*a*. The animal, from above; $\times 16/3$.

FIG. 3*b*. Cephalothorax, with one of the two mandibular palps, the proximal part of the walking legs and the basal portion of the abdomen,—the hairs everywhere omitted—from below; $\times 8$.—*a*. front margin of the cephalothorax; *b*. cucullus; *c*. mandibles; *d*. coxa of the first pair of legs; *e*. trochanter of the first pair of legs; *f*. second trochanter of the fourth pair of legs; *v³*. third sternite.

FIG. 3*c*. Cucullus, from above; $\times 20$.

FIG. 3*d*. Right antenna, from above (or from in front); $\times 36$.

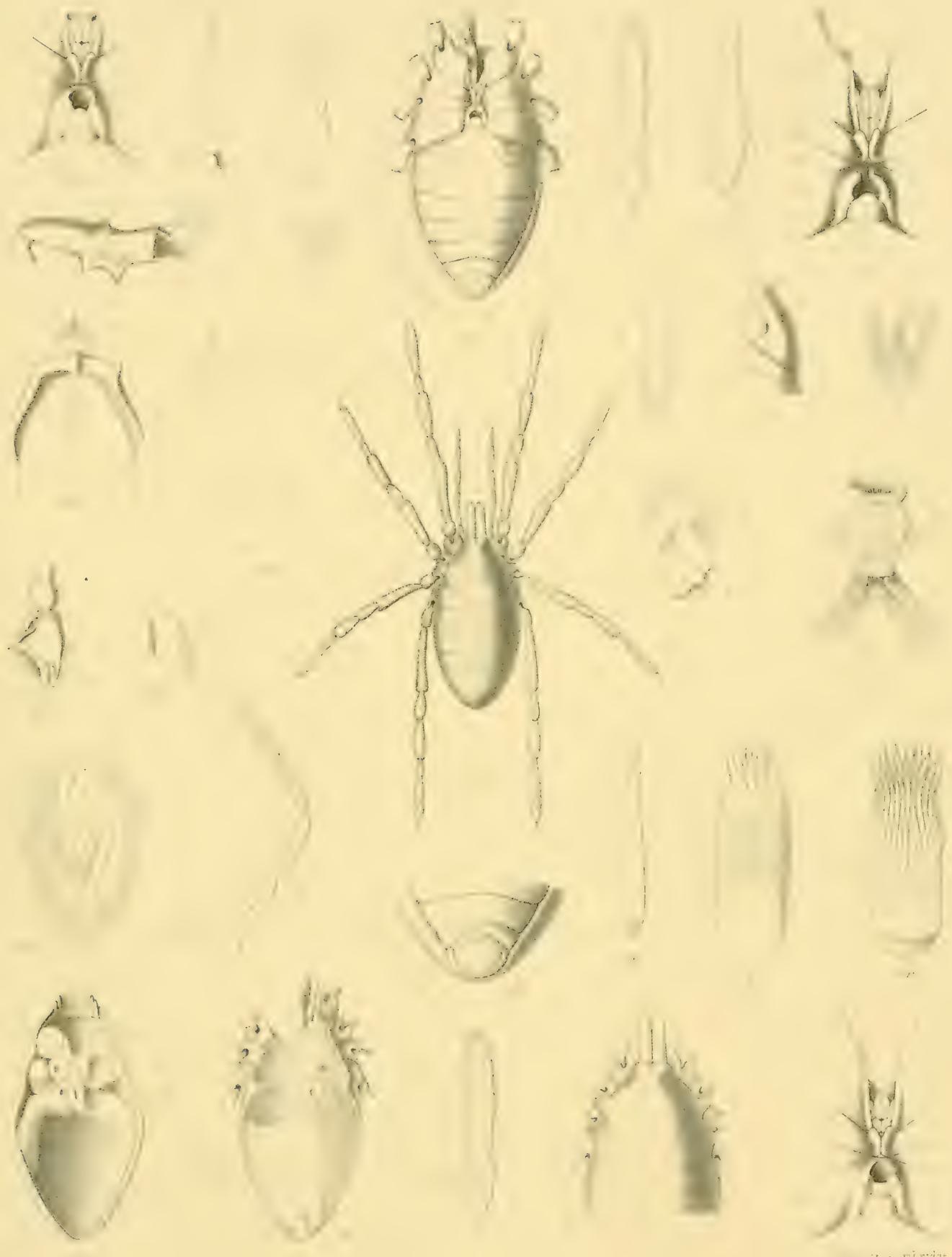
FIG. 3*e*. Left mandibular palp, from in front; $\times 19$.

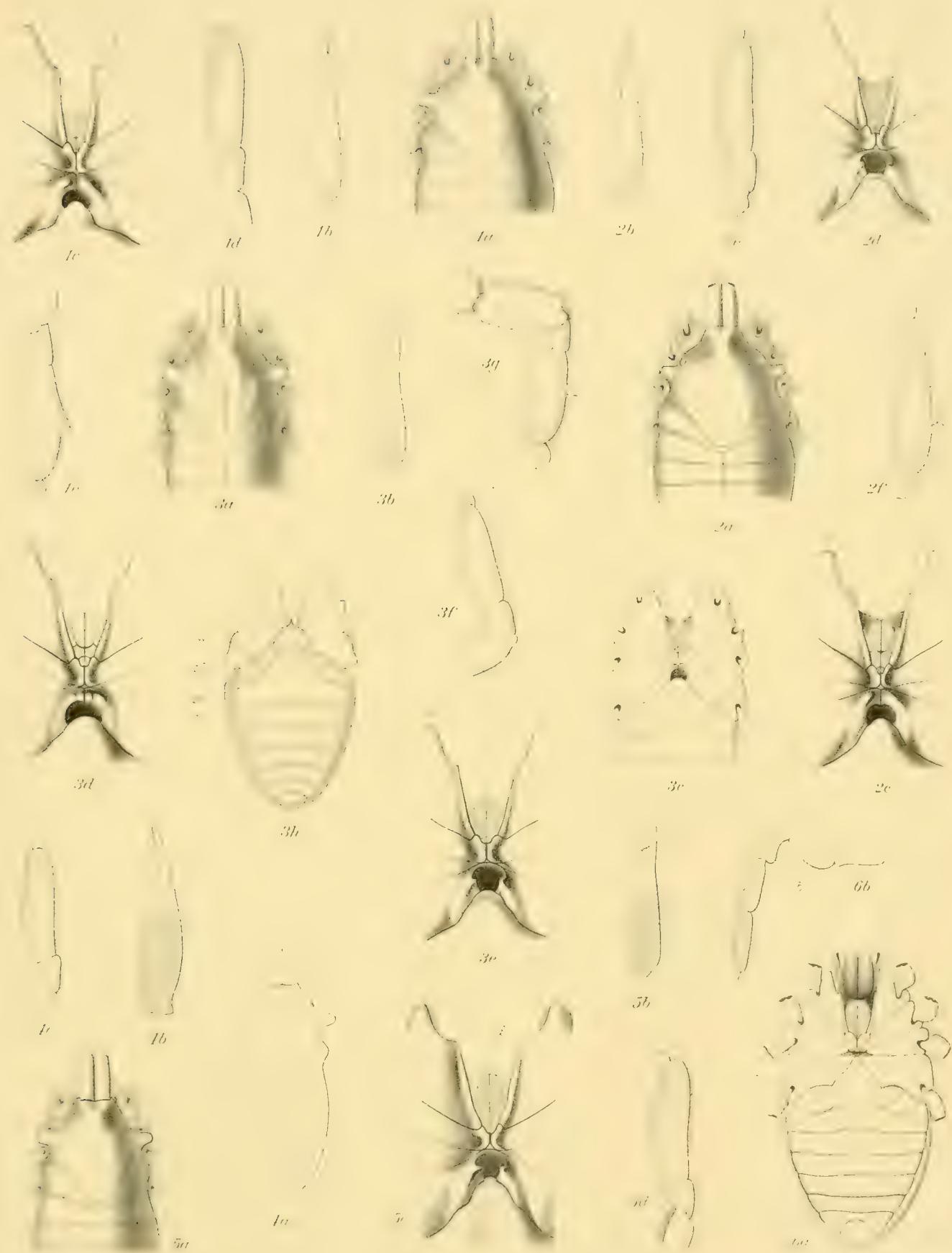
FIG. 3*f*. First right leg, obliquely from in front and from above; $\times 25/2$.

FIG. 3*g*. The major part of the leg shown in fig. 3*f*, from in front and with the hairs omitted; scarcely $\times 12$.—*f*. femur; *p*. patella; *t*. tibia.

FIG. 3*h*. Distal part of the third left leg, from behind; $\times 11$.—*a*. tibia; *b*. metatarsus; *c*. its movable process; *d*. first tarsal joint; *e*. second tarsal joint; *e'*. ‘lamina cyathiformis.’

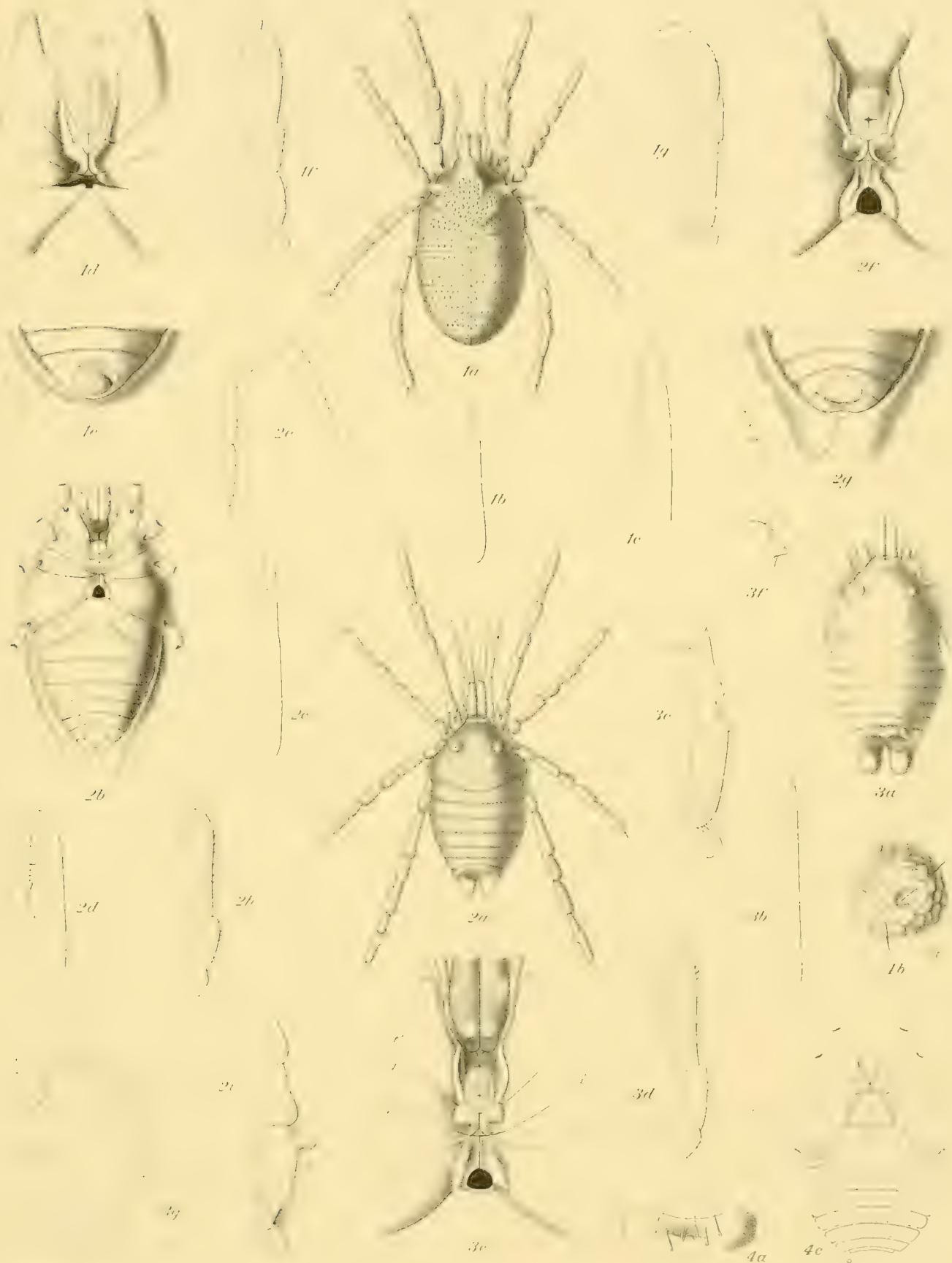
FIG. 3*i*. Distal part of the third left leg, from in front; $\times 19$.—*d'*. the movable process from the first tarsal joint; the remaining lettering as in fig. 3*h*.





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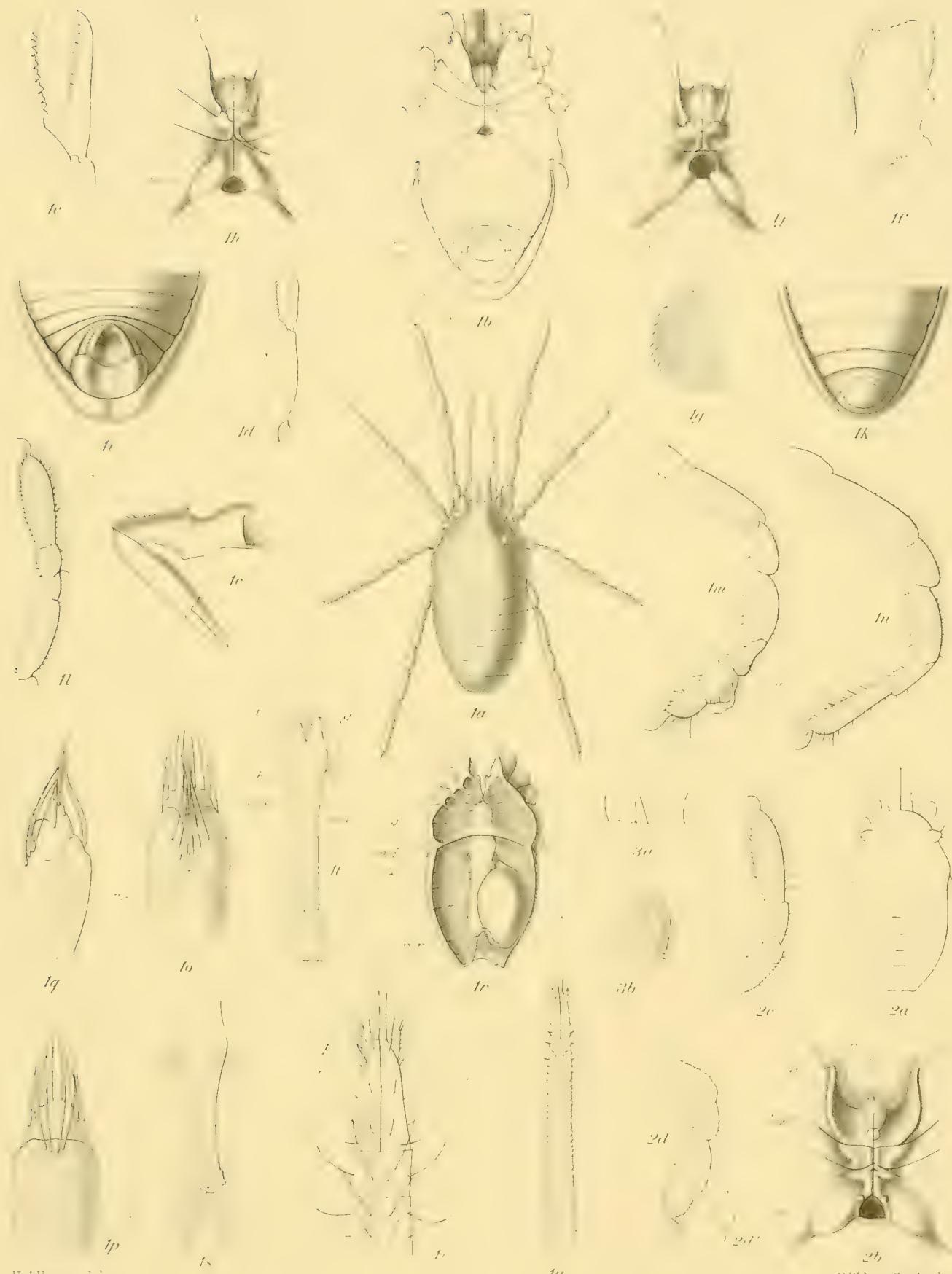
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genitalia. — 2. *Peltalis cimiciformis* Camer. ♂. *P. brevicauda* Poc.

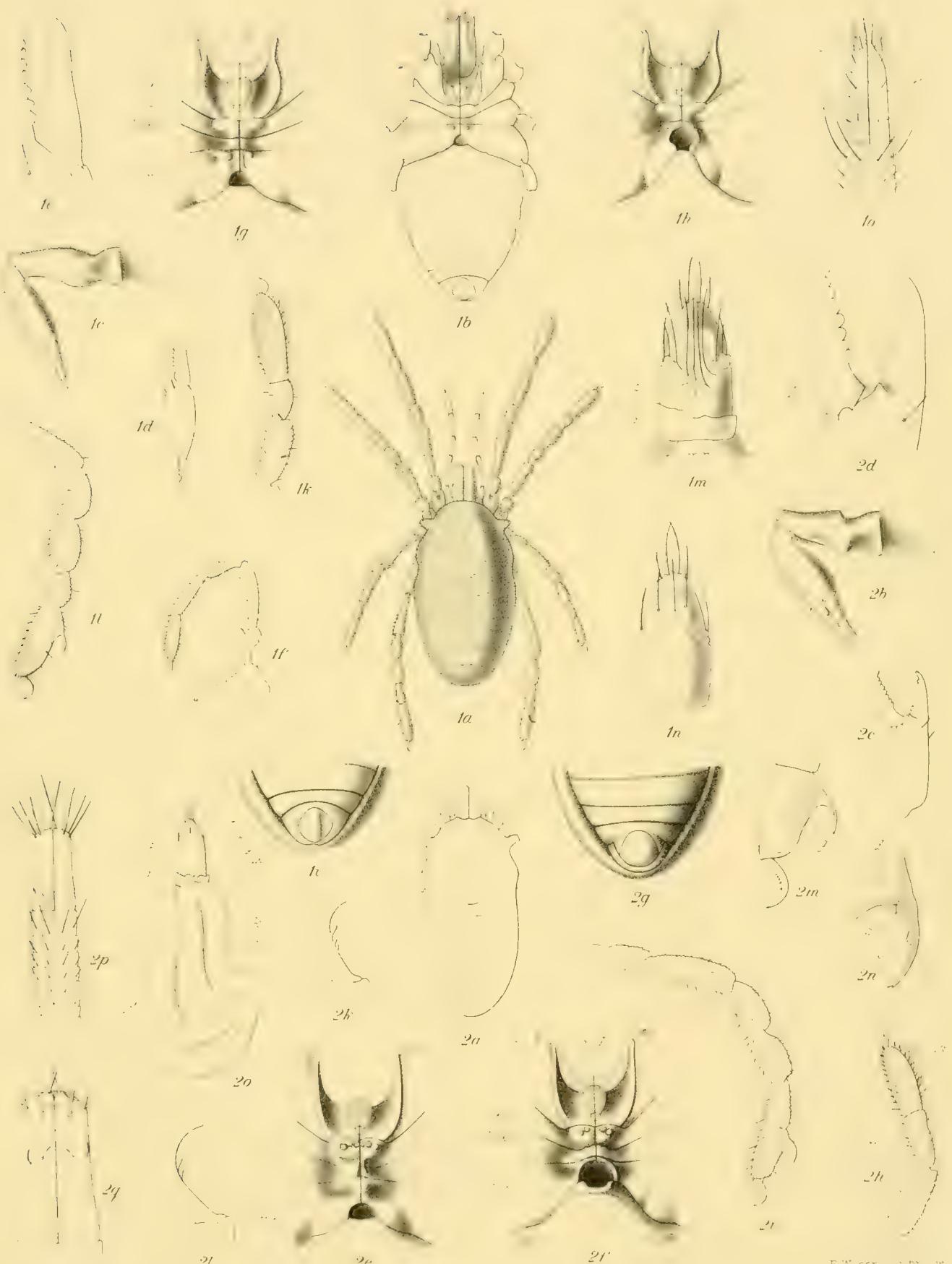
4. *Furcelli illustrans* n. gen., n. sp.

E. Wilson, Cambridge



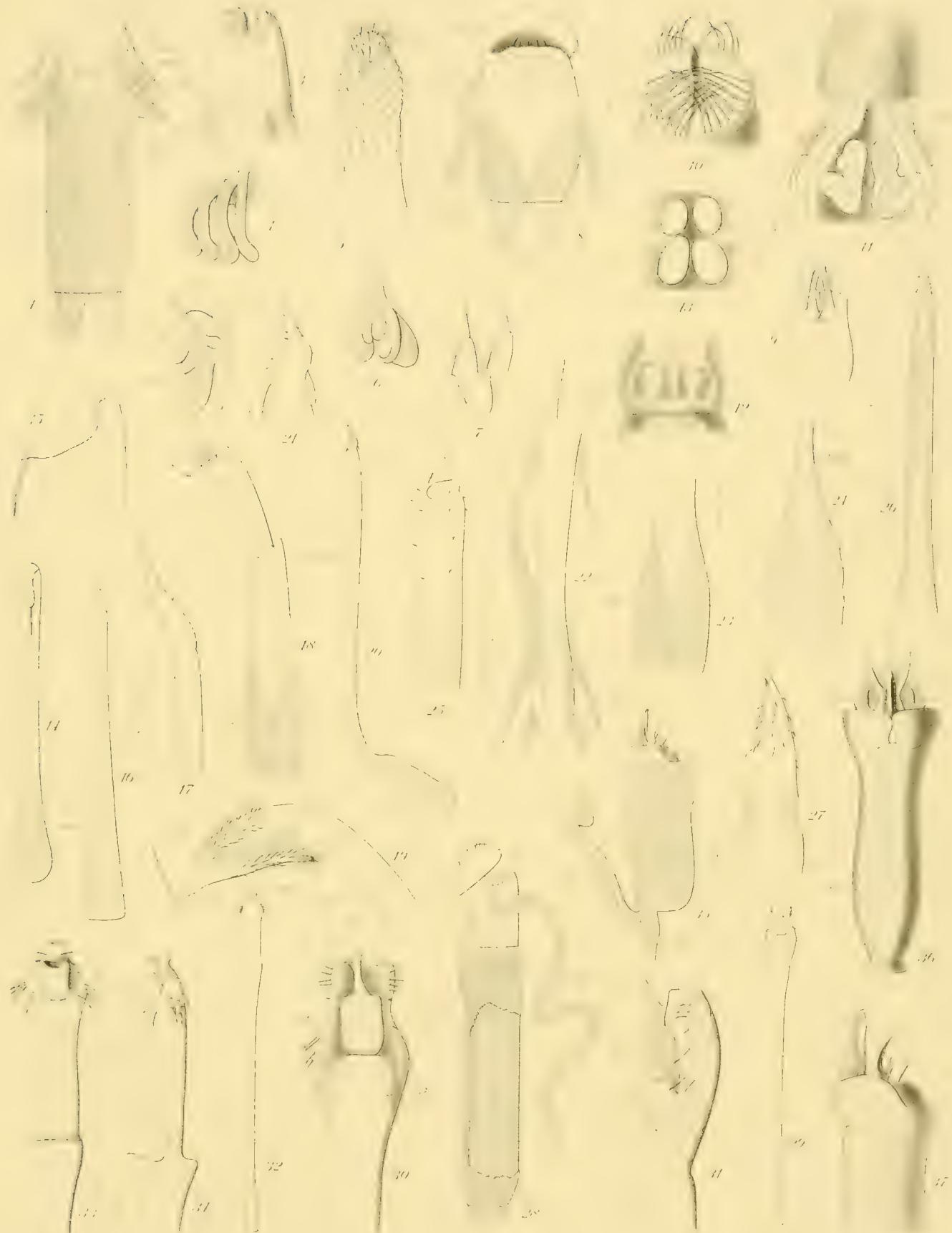
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EWILSON 1907

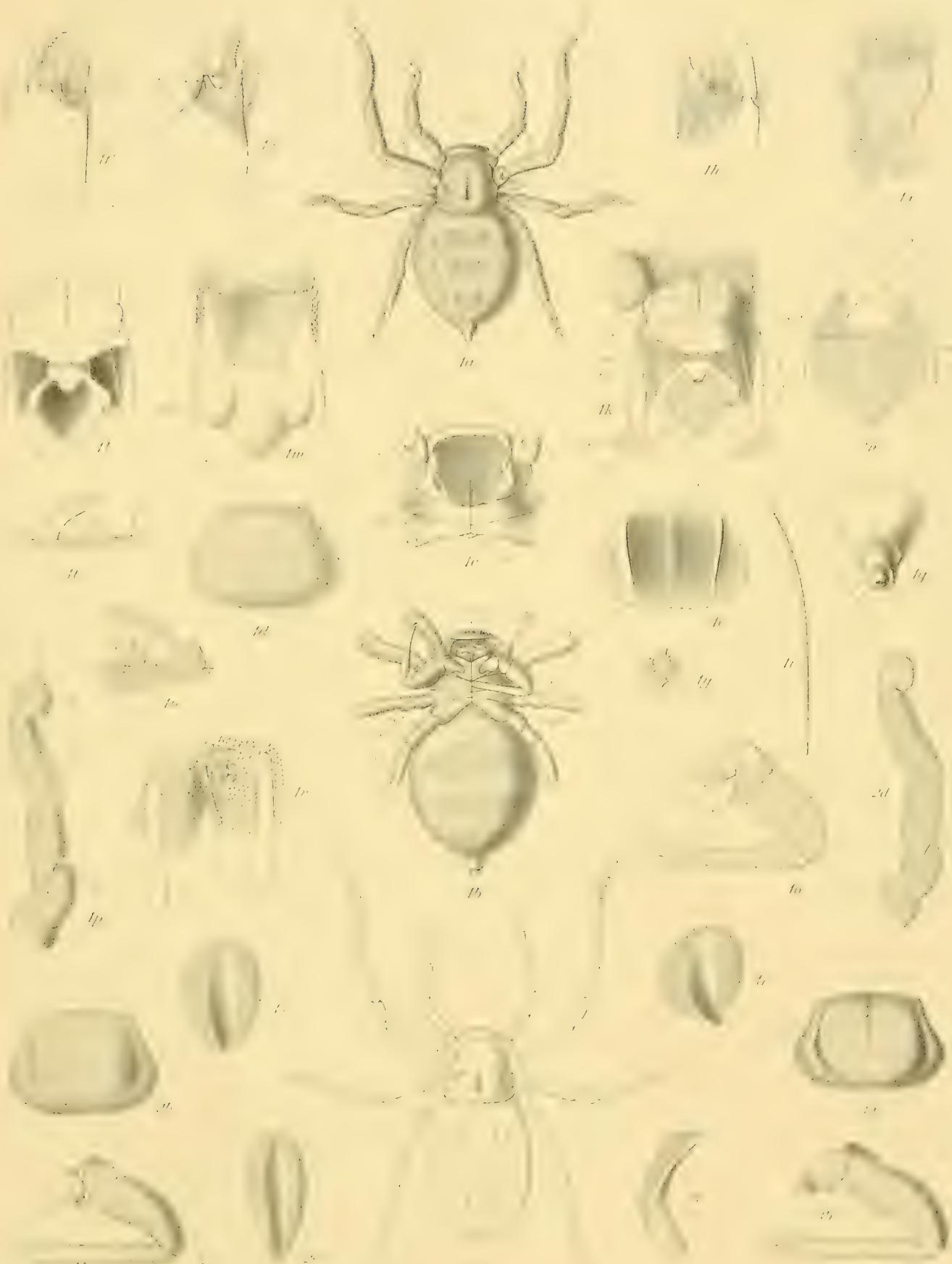
1. *Siro duricorius* Jos. 2. *Parasiro corsicus*



H. J. Hansen 1904

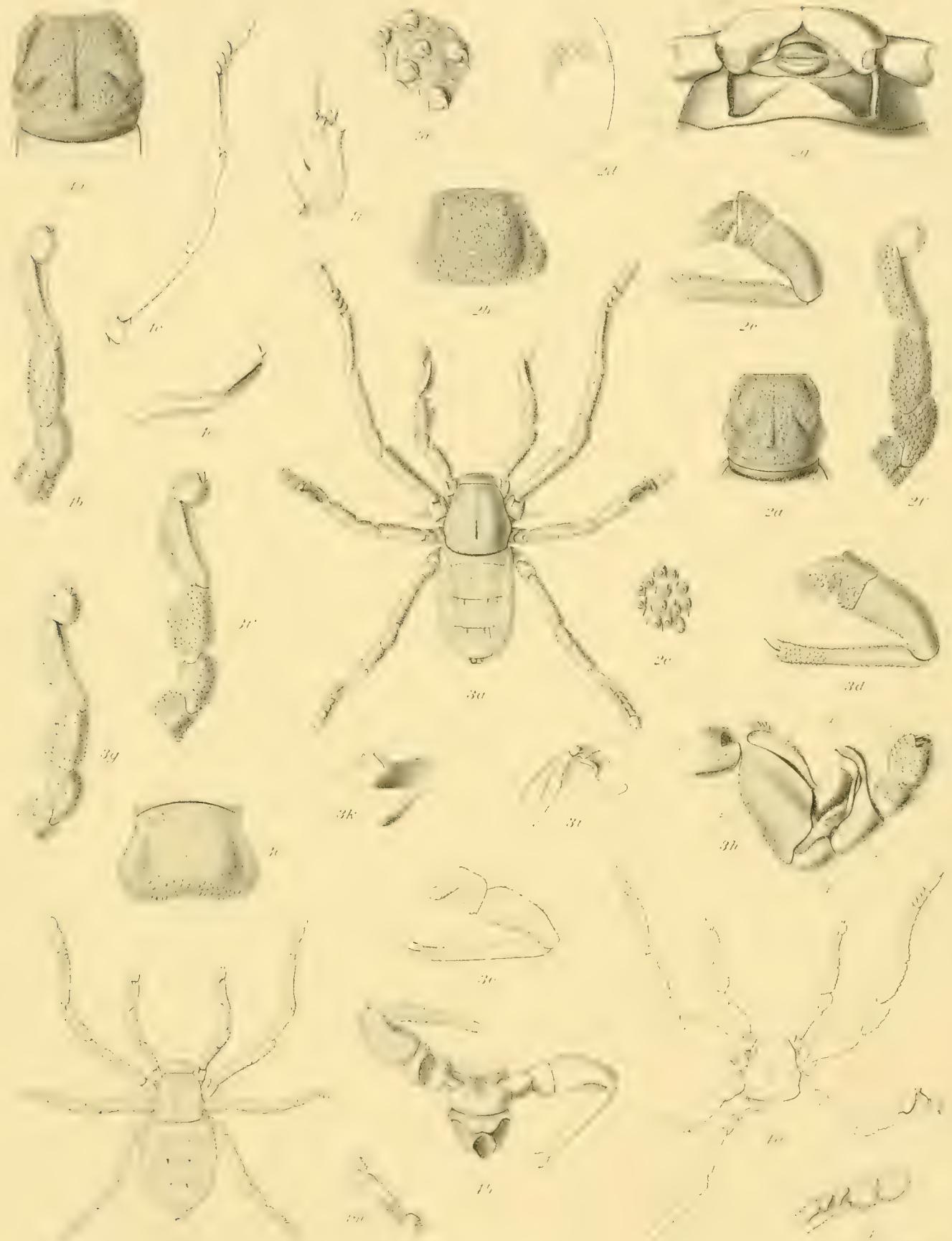
E. A. G. Simoni 1904

Sexual Organs in Opiliones Palpatores and Lammatores.



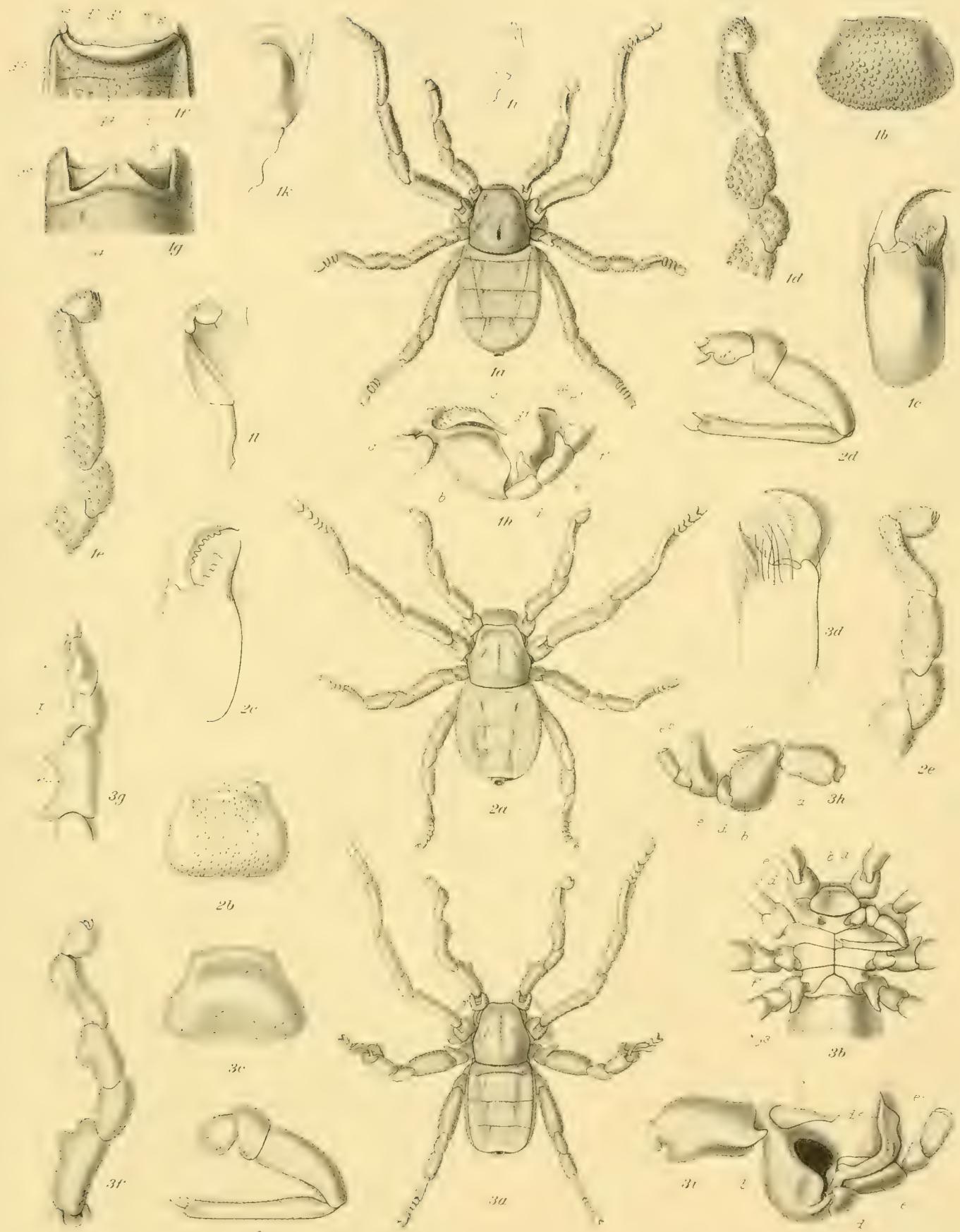
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E. N. L. S. in Cambridge



F. Wilson-Cartwright

1 Crustostoma Westermanni Guér 2 Cr. Afzelii Thor 3. Cr. Sjöstedtii n. sp.



H.J. Hansen del.

E.Wilson,Cambridge.

1. *Cryptostemma Karschii* n.sp. 2. *Cryptocellus foedus* Westw. 3. *Cryptoc. Simonis* n.sp.

INDEX.

ALL names of orders, suborders, tribes, families, genera and species in the two systematic *Latin parts* (pp. 78—113 and pp. 143—157) have been inserted alphabetically in the index. The number of the page on which the diagnosis, characterization or description of each of these groups or species will be found has been printed with dark numerals.

As to the zoological names in the *English parts* it has been deemed expedient to adopt a different mode of proceeding. A mere enumeration of names without any statement of the structure discussed on each page registered would in most cases have been of but slight value. In the description or discussion of structural features the name of the genus or species examined or mentioned is very often of little or no importance as compared with the name of the family or suborder to which the genus belongs, the genera or species examined being often casually chosen representatives of the family. If then the names of the families and suborders found in these parts had been omitted the value of the index would have been seriously lessened; on the other hand, if all names of genera and species mentioned in the text and also families and suborders should have been inserted together with statement of structure in each case, the index would have been disproportionately lengthy. Under the influence of these considerations we adopted the following principle. In the treatment of the order Opiliones detailed registering has been added to the names of the suborders, Cyphophthalmi, Laniatores and Palpatores; with the names of the families mention only of very characteristic features has been made; the names of the genera and species have been omitted unless any special reason necessitated their insertion. We hope that by this arrangement all requisite information on the structure of a form mentioned will be readily found under the name of the suborder. In a similar way information on a structural feature in the two genera constituting the order Ricinulei, viz. *Cryptostemma* and *Cryptocellus*, is to be looked for under *Cryptostemmatoidae*. We have also inserted such names as *Amblypygi*, *Arachnida*, *Condylopoda*, in order to refer to some discussions. Names of authors have been altogether omitted from the alphabetical list.

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